Ministry of Foreign Affairs and International Cooperation

Istituto Agronomico per l’Oltremare

University of Florence
School of Agriculture

Master of Science in

“Natural Resources Management for Tropical Rural Development”

Academic years
2014-2015
2015-2016
Istituto Agronomico per l’Oltremare
(Ministry of Foreign Affairs and International Cooperation)
School of Agriculture
(University of Florence)

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

Academic Years 2014-2015 and 2015-2016

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1 ORIGINS AND GENERAL INFORMATION

1.1 ISTITUTO AGRONOMICO PER L’OLTREMARE

The *Istituto Agronomico per l'Oltremare* (IAO) is the consultancy and technical assistance branch of the Ministry of Foreign Affairs on 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 busy 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 received its present name and was assigned to the Ministry of Foreign Affairs.

1.2 UNIVERSITY OF FLORENCE

The University of Florence (UNIFI) 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.

The University consists of 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 (UNIFI - University of Florence) and the Agronomic Institute for Overseas (Istituto Agronomico per l'Oltremare, IAO) in order to harmonize the experiences of three previous training programs, and to develop them further.

These programs included the Professional Master degrees 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 have evolved 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 (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, with particular attention paid to the protection of soil.

- 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 after the end of World War II 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 area of intervention the little and medium farms of the less industrialized areas of the globe. Mission of the MSc is the education and training of students expert in the technical and scientific areas of food production, environmental conservation and rural development, in order to research possible solutions at the food and water security, conservation of biological and cultural diversity and valorization of local tradition.
2 STRUCTURE OF MSc

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](http://www.miur.it/guida/capitolo3.htm). Student must acquire a total of 120 academic credits (CFU), organized as follows:

<table>
<thead>
<tr>
<th>Activity</th>
<th>CFU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classwork (lectures and laboratoires)</td>
<td>93</td>
</tr>
<tr>
<td>Final Thesis</td>
<td>27</td>
</tr>
<tr>
<td>Total CFU</td>
<td>120</td>
</tr>
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</table>

The degree is divided in a first common year and a second year with two different curricula “Agricultural Production” and “Land and Water”. Total number of exams: 11 (more Optional Courses and Laboratory)


<table>
<thead>
<tr>
<th>CLASSES</th>
<th>CFU</th>
<th>PROFESSOR</th>
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</thead>
<tbody>
<tr>
<td><strong>FIRST YEAR - COMMON CURRICULUM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On farm irrigation</td>
<td>6</td>
<td>Elena Bresci and Graziano Ghinassi</td>
</tr>
<tr>
<td>Agroclimatology</td>
<td>6</td>
<td>Marco Bindi</td>
</tr>
<tr>
<td>Agricultural geomatics</td>
<td>9</td>
<td>Luca Ongaro</td>
</tr>
<tr>
<td>Farming system analysis</td>
<td>6</td>
<td>Contini Caterina</td>
</tr>
<tr>
<td>Second semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tropical crops</td>
<td>9</td>
<td>Andrea Pardini, Enrico Palchetti and Edgardo Giordani</td>
</tr>
<tr>
<td>Crop protection</td>
<td>6</td>
<td>Antonio Belcari and Laura Mugnai</td>
</tr>
<tr>
<td>Tropical Plant Ecology (only for “Agricultural production“ curriculum)</td>
<td>6</td>
<td>Lorenzo Orioli</td>
</tr>
<tr>
<td>Irrigation with non conventional waters (only for “Land and water” curriculum)</td>
<td>6</td>
<td>Elena Bresci</td>
</tr>
<tr>
<td>Optional Courses</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
### Second Year - Curriculum "Agricultural Production"

#### First Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Instructor(s)</th>
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</thead>
<tbody>
<tr>
<td>Machinery systems in the tropical agrifood chain</td>
<td>6</td>
<td>Francesco Garbati Pegna</td>
</tr>
<tr>
<td>Rangeland management</td>
<td>6</td>
<td>Andrea Pardini</td>
</tr>
<tr>
<td>Livestock production systems</td>
<td>6</td>
<td>Andrea Martini and Arianna Buccioni</td>
</tr>
<tr>
<td>Plant breeding</td>
<td>6</td>
<td>Stefano Benedettelli</td>
</tr>
</tbody>
</table>

#### Second Semester

<table>
<thead>
<tr>
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<th>Credits</th>
<th>Instructor</th>
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</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td>9</td>
<td>Caterina Contini</td>
</tr>
<tr>
<td>Optional Courses</td>
<td>6</td>
<td></td>
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<tr>
<td>Final Dissertation</td>
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</tbody>
</table>

#### Second Year CFU

| Total CFU | 66 |

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### Second Year - Curriculum "Land and Water"

#### First Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information technology in irrigation</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Water resources evaluation and management</td>
<td>6</td>
<td>Elena Bresci</td>
</tr>
<tr>
<td>Land evaluation</td>
<td>6</td>
<td>Marco Bindi</td>
</tr>
<tr>
<td>Agronomy and soil management</td>
<td>6</td>
<td>Simone Orlandini</td>
</tr>
</tbody>
</table>

#### Second Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td>9</td>
<td>Caterina Contini</td>
</tr>
<tr>
<td>Optional Courses</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Final Dissertation</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

#### Second Year CFU

| Total CFU | 66 |

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### Total CFU

| Total CFU | 120 |
3 SUBJECTS

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.
- Putting all together: Visual image interpretation, integration of data sources, natural resources evaluation.

AGRO-CLIMATOLOGY

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.
• Climate change: impacts of climate change in agriculture, adaptation and mitigation strategies.
• Crop simulation models: Introduction to modelling in agriculture.

**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, including stress’s factors in tropical and subtropical systems.
• Disease control methods for an integrated management of the tropical agrosystems.
• Clinical diagnosis of the diseased plant. Interpretation of the symptoms.
• Prophylactic and curative measures. Integrated disease management.
• Ecology and diversity of insects in tropical areas.
• IPM and biological control.
• 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.
• 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 MANAGEMENT” 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 Elena Bresci

- 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.

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.
3.2 SECOND YEAR

Curriculum “Land and Water”

AGRONOMY AND SOIL MANAGEMENT

Simone Orlandini

- 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

- 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);
  - Local clime estimator (Climwat);
  - Local clime estimator (NewLocClim);
  - Crop water requirements calculator (Cropwat).

LABORATORY

Caterina Contini (Coordinator)

- GIS applications to agriculture.
LAND EVALUATION

Marco Bindi

• An historical perspective.
• The FAO Framework for Land Evaluation.
• Agro-Ecological Zoning.
• Applications to Agriculture.
• Forestry and Rangelands.
• Land Degradation and Desertification.

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.
Curriculum “Agricultural Production”

LABORATORY

_Caterina Contini (Coordinator)_

- GIS applications to agriculture.

LIVESTOCK PRODUCTION SYSTEMS

_Andrea Martini and Arianna Buccioni_

- Tropical climates and environments.
- 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 AGRIFOOD 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.)

PLANT BREEDING

_Stefano Benedettelli_

- Population genetics and basic statistics. Genetic and environmental components of the phenotype. Variance of phenotype and different components.

• 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 sticking rate.
• Grazing effects on the vegetation, grazing methodologies.
• Improvements for rangelands and pastures.

3.3 OPTIONAL COURSES

The student has 12 academic credits who call themselves "free," because it is the same student who can choose between credits that are useful for the work and for the language test.

The “free” academic credits are 6 in the first year and 6 in the second year. In the first year, the student that has chosen the Land and Water Management curriculum can select “Tropical Plant Ecology” as “free academic credits”. Instead, the student that has chosen Agricultural production curriculum can select “Irrigation with non-conventional waters” as free academic credits.

First year

<table>
<thead>
<tr>
<th>Curriculum</th>
<th>“Land and Water”</th>
<th>“Agricultural production”</th>
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</thead>
<tbody>
<tr>
<td>Free academic credits</td>
<td>Tropical Plant Ecology</td>
<td>Irrigation with non-conventional waters</td>
</tr>
<tr>
<td></td>
<td>Language test</td>
<td>Language test</td>
</tr>
</tbody>
</table>
## 4 STAFF

### 4.1 TEACHING STAFF

<table>
<thead>
<tr>
<th>Name</th>
<th>Body or Institution</th>
<th>Current position</th>
<th>Main activities and responsibilities</th>
<th>e-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antonio BELCARI</td>
<td>University of Florence</td>
<td>Full Professor</td>
<td>Dipterans Taxonomy and morphology, Insect Symbiosis, IPM in temperate and tropical crops</td>
<td><a href="mailto:antonio.belcari@unifi.it">antonio.belcari@unifi.it</a></td>
</tr>
<tr>
<td>Stefano BENEDETTELLI</td>
<td>University of Florence</td>
<td>Associate Professor</td>
<td>Genetics, Plant production and farmer participatory crop improvement</td>
<td><a href="mailto:stefano.benedettelli@unifi.it">stefano.benedettelli@unifi.it</a></td>
</tr>
<tr>
<td>Marco BINDI</td>
<td>University of Florence</td>
<td>Full Professor</td>
<td>Agrometeorology, crop modelling, climate change, environmental physiology</td>
<td><a href="mailto:marco.bindi@unifi.it">marco.bindi@unifi.it</a></td>
</tr>
<tr>
<td>Name</td>
<td>Body or Institution</td>
<td>Current position</td>
<td>Main activities and responsibilities</td>
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<tr>
<td>Elena BRESCI</td>
<td>University of Florence</td>
<td>Associate Professor</td>
<td>Water resources management, irrigation under water scarcity conditions, spate irrigation, diagnostic analysis of irrigation systems, wetland management and protection.</td>
<td><a href="mailto:elena.bresci@unifi.it">elena.bresci@unifi.it</a></td>
</tr>
<tr>
<td>Arianna BUCCIONI</td>
<td>University of Florence</td>
<td>Researcher</td>
<td>Animal feeding</td>
<td><a href="mailto:arianna.buccioni@unifi.it">arianna.buccioni@unifi.it</a></td>
</tr>
<tr>
<td>Caterina CONTINI</td>
<td>University of Florence</td>
<td>Researcher</td>
<td>Rural development, farming systems analysis, sustainable management of natural resources, consumer behaviour</td>
<td><a href="mailto:caterina.contini@unifi.it">caterina.contini@unifi.it</a></td>
</tr>
<tr>
<td>Name</td>
<td>Body or Institution</td>
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<tr>
<td>Francesco GARBATI PEGNA</td>
<td>University of Florence</td>
<td>Researcher</td>
<td>Agricultural mechanization, farm equipment, post-harvest and processing equipment</td>
<td><a href="mailto:francesco.garbati@unifi.it">francesco.garbati@unifi.it</a></td>
</tr>
<tr>
<td>Edgardo GIORDANI</td>
<td>University of Florence</td>
<td>Researcher</td>
<td>Fruit tree genetic resources and breeding, Perennial horticulture, Sustainable production of small berries</td>
<td><a href="mailto:edgardo.giordani@unifi.it">edgardo.giordani@unifi.it</a></td>
</tr>
<tr>
<td>Graziano GHINASSI</td>
<td>University of Florence</td>
<td>Researcher</td>
<td>Irrigation practice, system design and management, performance evaluation</td>
<td><a href="mailto:graziano.ghinassi@unifi.it">graziano.ghinassi@unifi.it</a></td>
</tr>
</tbody>
</table>
Andrea MARTINI

Body or Institution: University of Florence
Current position: Associate Professor
Main activities and responsibilities: Conservation of endangered breed, organic animal productions, animal welfare, unconventional medicine, tropical animal production and breekeeping. Erasmus coordinator

Laura MUGNAI

Body or Institution: University of Florence
Current position: Associate Professor

Luca ONGARO

Body or Institution: Istituto Agronomico per l’Oltremare, Florence
Current position: Technical Director
Main activities and responsibilities: Remote Sensing and GIS for natural resources evaluation, application of informatics to environmental sciences, IAO ICT management

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<table>
<thead>
<tr>
<th>Name</th>
<th>Body or Institution</th>
<th>Current position</th>
<th>Main activities and responsibilities</th>
<th>e-mail</th>
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</thead>
<tbody>
<tr>
<td>Lorenzo ORIOLI</td>
<td>Istituto Agronomico per l'Oltremare, Florence</td>
<td>Technical officer</td>
<td>Agronomist in development projects in Africa. Since 1992 I worked in agricultural projects and natural conservation programme.</td>
<td><a href="mailto:orioli@iao.florence.it">orioli@iao.florence.it</a></td>
</tr>
<tr>
<td>Simone ORLANDINI</td>
<td>University of Florence</td>
<td>Full Professor</td>
<td>Agrometeorology, climatology, agronomy, modelling crop production, climate change</td>
<td><a href="mailto:simone.orlandini@unifi.it">simone.orlandini@unifi.it</a></td>
</tr>
<tr>
<td>Enrico PALCHETTI</td>
<td>University of Florence</td>
<td>Researcher</td>
<td>Research on: tropical field crops, biofuels and bioenergy crops, renewable energies, Aromatic and scented plants. Erasmus commission member.</td>
<td><a href="mailto:enrico.palchetti@unifi.it">enrico.palchetti@unifi.it</a></td>
</tr>
</tbody>
</table>
Andrea PARDINI

Body or Institution: University of Florence
Current position: Associate Professor and President of the Course
Main activities and responsibilities: Pasture and rangeland management forage crops; tropical food crops; agroforestry (agrosilvopastoral systems)
e-mail: andrea.pardini@unifi.it

4.2 SUPPORT STAFF

Paolo Enrico SERTOLI

Body or Institution: Istituto Agronomico per l’Oltremare, Florence
Current position: Technical officer
Main activities and responsibilities: Water resources management; irrigation methods and water productivity; tropical agriculture production; monitoring and evaluation of cooperation projects.
e-mail: sertoli@iao.florence.it