

Science for Diplomacy: Multi-disciplinary Training Program

DIPLOMAZIA² **Science and Knowledge for Diplomacy**

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Consiglio Nazionale delle Ricerche

DIPLOMAZIA₂ – SCIENCE AND KNOWLEDGE FOR DIPLOMACY

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Preface

Science for Diplomacy is a fundamental tool for the development of International Cooperation, as it tries to ease, refine and enrich the relations and cooperation between countries.

Exchange of knowledge and innovation is one of the means to encourage scientific cooperation which in turn is an essential element for international diplomacy.

Since its creation, CNR played a decisive role in fostering scientific collaboration between countries, sometime, divided by ideological barriers: in fact, in 1923, the National Research Council was founded with the purpose to join the International Research Council (now International Council for Scientific Union, ICSU), a world scientific organization specifically conceived to allow collaboration among scientists from all countries, including those who, at that time, were working beyond the Iron Curtain. Those were the years when the awareness of the importance of science as a fundamental component of diplomacy started to grow.

In fact, sharing knowledge that crosses states' boundaries, allows to overcome the cultural barriers that often separate nations.

Having this in mind, CNR developed the project "Science for DIPLOMAzia2": a multi-sectoral training program" funded by MAECI-DGCS and AICS.

With this project, CNR has proposed three specific training courses ("Environment and Climate Change", "Agro-Food" and "Cultural Heritage") whose aim was to give researchers from the Mediterranean, Middle East and Balkan countries, the chance to carry out scientific activity in these fields.

The six months of joint activity have produced excellent collaboration between the foreign students and the Italian teachers but also between all participants. This booklet intends to leave a trace of what was scientifically produced by the 27 researchers during their training period which can be considered as a first segment of collaboration to be furtherly developed in the future, as happened with the DIPLOMAzia1 program.

In this project, scientific research has confirmed that science is able to get peoples closer; the exchange and transfer of "knowledge" helps development, enhances partnerships and dialogue and overcomes historical and cultural differences, enabling integration and coexistence between people with different habits, laws, and mindsets.

Virginia Coda Nunziante

Chapter 1

Introduction

Diplomazia2 is framed within the program "Science for Diplomacy: Multi-disciplinary Training Program", and it is the result of closer and more mature collaboration between the Directorate General for Cooperation on Development of the Ministry for Foreign Affairs and International Cooperation (MAECI), the Italian Agency for Cooperation on Development (AICS) and the National Research Council (CNR).

The implementation of joint projects such as DIPLOMAzia2 highlights the effectiveness of the diplomacy-science partnership as the driving force behind the achievement of relevant goals jointly pursued by the international community.

Research and science in particular show that, like many other times in experiences, they can be an extremely effective "diplomatic" tool for the strengthening of international relations and intercultural dialogue, often able to build where conventional channels instead fail.

The specific objectives of the project are to foster the consolidation of the beneficiaries' expertise and knowledge, and to intensify the network of collaborations through new partnerships for scientific and technological cooperation between Italy and the countries of origin, via new collaborative research projects or career development.

Through the highly qualified semi-annual professional training organized by the National Research Council in the thematic areas covered, the beneficiaries will be able to consolidate their experience and acquire new knowledge to be employed in the workplace of their countries of origin.

DIPLOMAzia2 intends to undertake a public cooperation action on development for the countries benefiting from the initiative, aiming to strengthen the process of institutional capacity building and local governance.

DIPLOMAzia2 will be a strategic investment of international cooperation for the global growth of the beneficiary countries, giving a solid contribution to improving the participants' individual working capability and revenue-generating skills. It will be then possible to improve the work system production processes in the environment, agro-food and cultural heritage sectors.

DIPLOMAzia2 follows the positive results achieved by the pilot initiative "DIPLOMAzia1", that opened the door to the possibility of a new programming cycle, of which DIPLOMAzia2 represents a new expression.

DIPLOMAzia2 is being proposed under the European Year for Development, which will also mark the deadline for the Millennium Development Goals (MDGs), whose aims will be reiterated in an increasingly ambitious context such as: the proliferation of negotiations for the definition of the future Development Agenda or the Paris Conference hosting the COP21. All appointments where global challenges such as the creation of a global sustainable development model, food and nutrition security, environmental protection and mitigation of climate effects, energy supply, increasing pressure on resources, which will be on the agenda of all international decision-making tables.

In accordance with the guidelines and programming designed by the Italian Cooperation for Development, DIPLOMAzia2's action will be of interest to the countries of the North-Africa, the Middle East and the Balkan Region, which, being located nearby Italian borders, are of particular strategic importance for our country.

In particular, recipients of the initiative will be officials and graduates from Tunisia, Egypt, Lebanon, Albania, Montenegro and Serbia who will benefit from a cultural and professional development course organized by CNR on key themes of scientific and technological research in:

- 1. Environment / Climate Change / Resilience with particular reference to the Mediterranean area;**
- 2. Management and use of agro-food resources aimed at the sustainability of agriculture and arboriculture, and the**

mitigation of the physical and biological effects of climate change;

3. Governance of knowledge, management, preservation, enhancement and sustainable use of Cultural Heritage.

The internationalization of scientific and technological research represents an important strategic goal of the European scientific policy, essential to economic growth and to address the new social challenges on a global level.

Through scientific cooperation, the European Union intends to:

- strengthen European scientific excellence and make science and innovation more attractive;
- contribute to address global societal challenges;
- support and back up the European Union's foreign policy.

To achieve these goals, the new science cooperation strategy focuses on research areas of common interest and mutual benefit.

DIPLOMAzia2 will respond to the need for these countries to strengthen institutional capacity building and governance, and the selected fellowship holders could be key players. Participating countries will acquire more qualified human resources capable of actively take part in the process of endogenous socio-economic development and local *ownership*.

At the same time, the shortage of specialized personnel, detected by the Italian scientific community, can be improved, with which to build new ways of scientific cooperation, generating sustainable growth, development and innovation.

More information about Diplomazia2: <https://www.cnr.it/en/diplomazia2-program>

Chapter 2

Involved Structures

CNR is a public research organization that carries out, promotes and disseminates research activities in the major areas of knowledge and their employment, for the nation's scientific, technological, economic and social development. CNR's activities are organized in macro-areas of scientific and technological research covering a variety of fields: Earth system science and environmental technologies (DTA); Biology, agriculture and food sciences (DiSBA); Biomedical Sciences (DSB); Chemical Science and Materials Technology (DSCTM); Physical sciences and technologies of matter (DSFTM); Engineering, ICT and technologies for energy and transportation (DIITET); Social sciences and humanities, cultural heritage (DSU).

The project involves several CNR structures: International Relations Office, established within the Office for European and International Relations of CNR General Directorate; for the Department of Earth system science and environmental technologies: ISAC (Institute of Atmospheric Sciences and Climate, Roma), IRPI (Research Institute for Geo-Hydrogeological Protection, Bari) and IGG (Institute of Geosciences and Earth Resources, Pisa); for the Department of Biology, agriculture and food sciences: IBIMET (Institute for Biometeorology, Florence), IVALSA (Tree and Timber Institute, Sesto Fiorentino), IPSP (Institute for Sustainable Plant Protection, Bari), ISPA (Institute of Science of Food Production, Bari); For the Department of Social sciences and humanities, cultural heritage: IBAM (Institute for Archaeological and Monumental Heritage, Catania), ISMA (Institute for the Studies on Ancient Mediterranean, Montelibretti), ITABC (Institute for Technologies Applied to Cultural Heritage, Montelibretti), ICVBC (Institute for the Conservation and Promotion of Cultural Heritage, Montelibretti).

2.1 International Relations Office

International Relations Office, based at CNR's Headquarters, promotes the development of International Cooperation through a series of actions that include the exchange of researchers carrying out joint and free research projects; it manages bilateral Agreements on Scientific and Technological Cooperation with foreign corresponding institutions based in all continents; it encourages the participation of Italian researchers in scientific activities at foreign institutions via the Short Term Mobility Program (STM); it supports and maintains close collaborative relations with the Italian scientific attachés at the Italian Representations abroad and with the scientific officers of the Foreign Embassies in Italy.

In addition, in cooperation with the Ministry of Foreign Affairs and the Ministry of Education, University and Research, it assures Italian representation in the major international institutions and international non-governmental organizations and runs the scientific activities deriving from Intergovernmental Agreements.

It participates in the implementation and management of major international initiatives and projects.

The Head of the International Relations Office has recently received official mandate to manage the activities of the European and International Relations Office. The European and International Relations Office coordinates and inter alia promotes the participation of CNR's Scientific Network in Community programs through training courses on the European Commission's initiatives.

General coordination, operational management, monitoring and reporting on the first "Science for Diplomacy" project was entrusted to the Structure of International Relations.

More information about CNR's International activities:

<https://www.cnr.it/en/international-activity>

2.2 Department of Earth system science and environmental technologies

The DTA institutes involved in the project (ISAC, IRPI and IGG) deal with atmospheric science, climate change, hydrogeological risk and impacts of

global changes on the environment and on surface and underground water resources.

<http://www.dta.cnr.it>

INSTITUTE OF ATMOSPHERIC SCIENCES AND CLIMATE (ISAC)

The mission of the ISAC is to provide an advanced understanding of atmospheric processes at different spatial and temporal scales through a multidisciplinary approach that includes meteorology, climate, atmospheric composition and observation of the earth. ISAC operates in a broad spectrum of activities that include basic research, development and use of different complexity models, observational monitoring, instrumental development, and impact analysis.

ISAC is CNR largest institute in the field of atmospheric sciences and is present on the whole national territory (7 units in Italy, 7 atmospheric observers in Italy and abroad including 2 Global Atmospheric Watch-WMO stations and 2 Measuring Supersites), as well as being part of many international research networks.

Scientific activity is structured in 8 lines dealing with various issues of climate and environmental research: fundamental climate processes, water cycle, regional and global predictability, the development of numerical models for analysis and forecast, in situ and satellite observations of the atmosphere-ocean system, evaluation at various scales of constituents' balance in the atmosphere, assessment of environmental risk on cultural heritage. The Institute applies the results of research to climate and meteorological forecasting, to the assessment of environmental impact on health and climate, to the development of observational infrastructures and advanced analysis technologies.

<http://www.isac.cnr.it>

RESEARCH INSTITUTE FOR GEO-HYDROGEOLOGICAL PROTECTION (IRPI)

The research and technological development activities of IRPI mainly concern the geo-hydrological natural hazards, and in particular floods and overflows, dredged castings, landslides (also induced by earthquakes), erosive, glacial and peri-glacial phenomena, coastal variations, subsidence and raising

phenomena, pollution and depletion of surface and underground water resources. IRPI researchers also study the impact of climate change on geo-hydrological risk and geo-resources. Research aims to improve knowledge and to define criteria, methods, models and tools for predicting and preventing geo-hydrological events and their consequences, for risk definition and mitigation, and for identifying and implementing the adaptation strategies.

<http://www.irpi.cnr.it>

INSTITUTE OF GEOSCIENCES AND EARTH RESOURCES (IGG)

The main activities of IGG concern basic and applied research on the internal and external dynamics of the Earth System at multiple spatial and temporal scales, including mineralogy and petrography, geochemistry, geodynamics, geomorphology, geothermal energy, hydrological cycle dynamics (with particular attention to groundwater and aquifers), environmental processes and pollution phenomena, impacts and risks associated with global change. These activities define the two major areas of IGG's activities related to geological sciences (geology, geochemistry, geodynamics, geothermal energy) and environmental sciences (pollution, risks, impact of climate change, sustainability). The methods used include laboratory analysis, field monitoring and measurements, geological mapping, conceptual and numerical modeling.

<http://www.igg.cnr.it>

2.3 Department of Biology, agriculture and food sciences

The Institutes' network of Bio-Agro-Food Sciences (DiSBA) research and transfer activities on issues related to the management and use of agro-food resources, with particular interest in the Mediterranean area, the sustainable use of resources and the mitigation of the effects of climate change. The project includes 4 institutes: IBIMET, IVALSA IPSP, ISPA, competent in the different areas described below.

<http://www.disba.cnr.it>

INSTITUTE OF BIOMETEOROLOGY (IBIMET)

Climate Change: Impact and Adaptation in Mediterranean Agriculture.

The Mediterranean basin represents one of the most complex systems in the world, bringing together very diverse countries, both in terms of economic structure and production systems, and in terms of ecosystems and cultures; realities that have always learned to develop within a logic of interaction and integration.

This multiplicity and dynamism of the systems in the area has eased the emerging of a common environment within which any positive or negative event occurring in a given country affects the neighboring areas by altering the social, productive, environmental and economic context. These events are thus able to act both as catalysts for new growth processes, as well as factors triggering potential conflicts and social tensions.

The globalization process has further intensified the inter-dependency mechanisms between countries in the Mediterranean area, favoring, above all, the development of new technical and cognitive tools, the circulation of information and the possibility of sharing common languages for dialogue and exchange, able to overcome any socio-political tension.

In this scenario, climate change is radically modifying the reference models of a sector fundamental to the balance of the region, such as agro-food, given its role in food security and socio-economic development. It is thus important to consolidate the scientific and technical community that is concerned with climate and agriculture, in order to integrate and develop a common language fit for the challenges that climate and agricultural change impose.

The main objective of the initiative is to improve the capabilities of the National Technical Services and Research Systems of the Mediterranean Area Countries in studying and managing the impact and adaptation to climate change in agriculture. IBIMET deals with the following topics:

- Climate and climate change in the short, medium and long term;
- Climatic impacts on agriculture: extreme events and expected evolution of climate change;
- the adaptation of agricultural industries to climate change;
- the geography of agricultural products for climate change;
- seasonal weather forecasts for agriculture;
- production forecasts and early warning;
- monitoring and forecasting of drought;
- assessment of the state of the land cover / vegetation;
- the role of agriculture in mitigating climate change.

<http://www.ibimet.cnr.it/>

INSTITUTE FOR SUSTAINABLE PLANT PROTECTION (IPSP)

“IPSP studies plant response to biotic and abiotic stress factors, with the aim of identifying mechanisms of resistance and adaptation, to promote plant health in agriculture and forestry. This implies strengthening the use of natural enemies and beneficial microorganisms in integrated pest management, selecting and recovering valuable plant germplasm, identifying bio-molecules of agricultural or industrial interest, and ultimately promoting a sustainable and environmentally friendly growth.”

Why is it important to protect plants? Why using sustainable technologies to do it?

We often tend to forget that what we eat comes from the fields and that crops depend heavily on many environmental factors that could limit the food production. Diseases, pests and weeds cause a dramatic decrease in the crop production, which accounts for an estimated 50% of the potential productivity. Not to mention all the problems caused by atmospheric agents, such as drought and overheating.

We all know that human diseases travel very easily around the world. Just think about the Ebola virus and the Avian Influenza. The same happens to plants: globalization and climate changes are constantly posing new emergencies. The most recent example is the death of olive trees in Southern Italy (Apulia Region) caused by *Xylella fastidiosa*, which has represented the first report of this bacterium in Europe. This disease poses a very serious threat and raises a lot of concern not only in the Apulia Region, but also in the Italian government and in the European Union. Both Institutions are now financing IPSP to gain more insights into this disease. There are many pests that come from other countries and spread without any control: some are pathogens (viruses, phytoplasmas, bacteria, fungi), others are insects, mites, nematodes and weeds. Part of these invasive species with relevant economic importance are studied at IPSP: insect vectors, such as whiteflies and thrips, which are vectors of geminiviruses and tospoviruses, the chestnut gall wasp, the *Flavescence dorée* phytoplasma, fungi that cause the cypress bark canker, etc...

The mission of the Institute is not only to identify plant pests and diseases, but also to provide sustainable and eco-friendly defense (or at least containment) strategies against them. For the specific purpose, our research is focused on: the biological control of plant diseases by the application of insects and antagonistic fungi, the improvement of the interactions among plants/mycorrhizal fungi/beneficial soil bacteria, the selection of resistant

cultivars and the recovery of economically important species. Many of these scientific activities are carried out in collaboration with private companies, such as seed producers, nurseries and diagnostics services.

<http://www.ipsp.cnr.it>

TREE AND TIMBER INSTITUTE (IVALSA)

Management of Arboreal Genetic Resources (IVALSA, Florence).

The Bank of Germplasm Arboreal, located at IVALSA, represents a strategic storage of fruit and olive trees of agro-food interest. It has over 15,000 plant varieties, including the largest Italian olive collection, essentially from Italy and the Mediterranean basin. In addition to the traditional conservation on farm at the experimental company of Follonica (GR), the material is stored in vitro, a technique that guarantees correct propagation in purity and absence of pathogens of the preserved material. IVALSA has developed expertise in advanced plant genetic engineering (RGV), integrating its expertise with those of other CNR Institutes with which it collaborates closely.

IVALSA's core activities include:

- Morphological and functional analysis of in vivo germoplasm, analysis of the interaction of the genotypes preserved with the biotic and abiotic environment;
- Slow growth in vitro retention, aimed at long conservation and maintenance in the absence of pathogens of tree propagation material;
- innovative micro propagation techniques (in vitro propagation) and in vitro selection of new genotypes of olive;
- detection and conservation of germplasm and biodiversity of woody species useful to the agro-food and agro-industrial system.
- protection of tree germplasm (IPSP Institute of Sustainable Plant Protection, Bari)
- Training activities on the following Mediterranean crops: vine, olive, citrus fruit and apricot (apricot, cherry, almond, plum, peach).

In particular, given the expertise and experimental / applied activities carried out by IVALSA research group, the specific issues that will be addressed in this project are:

- Clonal and sanitary selection of Mediterranean crops;
- management of ex situ collections of Mediterranean tree crops;
- sanitary improvement of Mediterranean arboreal crops;

- in vivo and in vitro multiplication of germplasm;
- legislation on the production and certification of Mediterranean propagation material;
- Variety / Clone Registration Procedures for National Catalogs.

Given the close collaboration with the Basile Caramia Center for Research, Experimentation and Training in Agriculture, which hosts most germplasm collecting fields (co-established with IVV-BA) and which manages the regional premoltification nucleus Vineyards, olive trees, citrus fruits and drupaceae, we consider it useful that some of the application activities of the stage could be held in Locorotondo (Bari) at the CRSFA facilities, where the following topics could also be developed within the institutional activity of CRSFA itself:

- variety identification on a morphological basis (ampelographic / pomological);
- surveys and characterization of the germ-plasm-productive and technological performances;
- breeding and evaluation of new vine and drupaceous crosses.

<http://www.ivalsa.cnr.it/>

INSTITUTE OF SCIENCE OF FOOD PRODUCTION (ISPA)

Identification of fossil-derived fungal pathogens of plants of interest for Mediterranean agriculture (ISPA, Bari)

ISPA operates in the field of research, innovation and technology transfer to improve the quality and safety of agro-food products. The Institute supports technological innovation paths of small, medium and large national and foreign companies in the agro-food industry. In particular, in the field of food safety, projects are under way with innovative methodologies, for the determination of mycotoxins, toxigenic fungi, pathogenic microorganisms and allergens in raw materials and foods such as cereals, wine, pasta, milk, child food and dried fruit. In addition, projects are under way for the enhancement of local productions (dairy products, breads, salami, fruit and vegetables) and the development of new probiotic and functional foods from typical Italian and foreign local products and, in collaboration with local health-care facilities to study the effectiveness of such products on human health.

Important technical and scientific skills with implications in the production system include:

- Creation of microorganism collections for agro-industrial applications;
- Elaboration of new lines of functional products such as olives and probiotic artichokes, or fermented beverages;

- Identification of quality markers for the traceability of typical products;
- development of biological diets for fish of commercial interest;
- innovative solutions for the packaging of IV fruit and vegetable products;
- Identification of new fruit and vegetables for the IV and V range;
- development of new bio-preserving substances to increase shelf-life of foods;
- use of beneficial microorganisms and natural substances for plant protection with low environmental impact methods;
- re-use in agriculture of waste from organic matrices.

<http://www.ispacnr.it>

2.4 Department of Social sciences and humanities, cultural heritage

For the Department of Social sciences and humanities, cultural heritage (DSU) of CNR, there are 4 institutes (IBAM, ICVBC, ISMA and ITABC) whose research fields are described below.

<http://www.dsu.cnr.it>

INSTITUTE FOR ARCHAEOLOGICAL AND MONUMENTAL HERITAGE (IBAM)

IBAM is a multidisciplinary research Institute with high expertise and specialized skills in the field of knowledge, documentation, diagnosis, preservation, enhancement, fruition and communication of archaeological and monumental heritage. These skills are expressed through the multidisciplinary personnel of IBAM, composed of archaeologists, architects, geologists, engineers, chemists, physicists, computer scientists in addition to technical staff which supports actively all research lines.

IBAM has played a key role in multidisciplinary research activities, thanks to its scientific missions in Turkey, Greece, Spain, Iraq, Perù, Albania and other foreign countries, acquiring furthermore a significant experience in the development of projects and European research programs focused on technology transfer, development of ICT technologies, training activities all aimed at improving and enhancing a deep knowledge of archaeological

heritage. Internationalization of research, strengthening of multidisciplinary studies, better communication among the four offices, success and excellence in European research projects and finally more investments in young researchers, constitute the main commitments of IBAM's vision.

IBAM strategic research activities are about the study of technologies used for: the management of cultural information systems; cataloguing methods for the study of tangible and intangible archaeological heritage; the development of embedded laboratories on bioarchaeology, archaeometry and communication; the use of the latest information technologies employed for 3D reconstructions, augmented reality and web dissemination. The long-term aim of IBAM is to better share scientific data and disseminate in a more effective way the understanding of monuments and archaeological contexts.

To this end, IBAM works closely with the Convergence regions and policy planning departments aiming at creating in collaboration with regional, national and local authorities, several advanced research centres which can handle the realization of multiple initiatives on Cultural Heritage.

<http://www.ibam.cnr.it/en/>

INSTITUTE FOR THE CONSERVATION AND PROMOTION OF CULTURAL HERITAGE (ICVBC)

ICVBC has its own distinctive profile in the panorama of Italian organizations working in the field of cultural heritage, both within CNR and the Ministry for Cultural Heritage, due to its long research experience and the multidisciplinary vocation of its researchers.

The methodological setting of restoration (and conservation in general) has changed dramatically since Cesare Urbani. Nowadays, it is universally acknowledged the need for a more comprehensive approach using technical, scientific and humanistic disciplines aimed at knowing and defining the best practices for the preservation and enhancement of cultural heritage.

In this scenario, thanks to the synergic action of the three sites (Florence, Rome and Milan), the Institute operates both nationally and internationally (Spain, France, Greece, Croatia, China, USA, Brazil, Armenia, etc.), also through collaborations and partnerships with scientific institutions and organizations responsible for the protection of cultural heritage as well as with private individuals, companies, associations and foundations working in the field of conservation and enhancement. ICVBC is also very active in the

development of technical regulations both at national and European level concerning diagnostics, preservation and restoration of art works.

Counting on the expertise of chemists, geologists, engineers, archaeologists and historians of the city, ICVBC is able to operate in the field of cultural heritage, developing innovative research and methodologies for better knowledge, conservation and enhancement of the artistic, monumental and urban heritage, both tangible and intangible.

In particular, the research activity is developed on topics such as:

A) Characterization of the materials constituting the art works and the development of methodologies for the definition and monitoring of the state of conservation of the surfaces. Strong of a thirty-year long activity in the study of stone and pictorial materials derived from the on-site study of over 300 artifacts, the work is now aimed at optimizing analytical techniques for the characterization of materials and the development of methodologies and protocols for evaluating the changes induced over the time by the interactions between environment and materials; particular attention is being paid to the development of protocols that use non-invasive instrumentation and techniques to measure critical parameters for the preservation of artifacts.

B) Experimenting new technologies and materials for the conservation and development of innovative design criteria and conservation interventions. This activity is aimed at optimizing conservative practices for stone, paint and metal surfaces, taking into account the three fundamental operations that are being carried out in the restoration sites (cleaning, consolidation and protection) and the methodologies with which they are implemented (physical and chemical). Physical methods include laser cleaning techniques and the use of electromagnetic radiation to control bio-deterioration. Chemical methods include chemical products such as cleaning agents (supported on suitable materials), consolidating (polymeric or inorganic) and protective (synthesis polymers), evaluating performance, physical-mechanical compatibility, stability and durability.

C) Development of innovative projects for the sustainable conservation and enhancement of historic centers. Following a careful examination of the issues regarding the use of Cultural Heritage, anthropic risk has been identified as one of the less studied parameters for sustainable fruition. In fact, one of the consequences of the valorization can bring to the increase of fruition which implies a possible greater risk of degradation. The strong tourist pressure on urban and archaeological historic sites has often negative implications that require appropriate intervention policies and at the same time the need to make cultural assets enjoyable in their aesthetic values. Based on these

considerations, the research activity has focused on the conservation and sustainable development of historic centers by developing the Preserving Places methodology for monitoring the impact of tourism.

<http://www.icvbc.cnr.it/>

INSTITUTE OF STUDIES ON THE ANCIENT MEDITERRANEAN (ISMA)

ISMA was created in 2012 through the fusion of the Institute of Studies on Ancient Mediterranean Civilizations (ISCIMA) and the Institute of Studies on Aegean and Near East Civilizations (ICEVO).

ISMA's activities are closely linked to the goals of CNR's 'Humanities and Social Sciences, Cultural Heritage' Department. ISMA, in fact, carries out historical, archaeological, philological and linguistic interdisciplinary research on ancient civilizations of the Mediterranean basin, from East to West (Syro-Mesopotamian, Anatolian, Egyptian, pre-Islamic Arabian, Levantine, Phoenician-Punic, Aegean, Etruscan-Italic, Greek, Roman, North-African and Iberian areas) and from Proto-Historical to Late Antique periods (4th millennium BC-1st millennium AD). Further investigations include the computing and information technologies applied to archaeology, and the history of the studies on Mediterranean antiquities, with main focus on the 19th and 20th centuries. ISMA's activities are integrated by archaeometry and digital applications, in order to design innovative solutions for archaeological, philological, linguistic and historical data managing.

ISMA has an intensive editorial activity, reflecting its broad research interests, with three journals and numerous monographs series representing major reference points for studies on ancient cultural heritage.

ISMA also owns a large library of more than 26.000 volumes, specialised in the ancient civilizations of the Aegean, Anatolia, Near East, North Africa and Italian peninsula as well as in issues related to the enrichment, safeguarding and enhancement of cultural heritage.

ISMA entertains close collaborations with Universities and other national and international Research Institutions, Museums and Superintendencies.

<http://www.isma.cnr.it>

INSTITUTE FOR TECHNOLOGIES APPLIED TO CULTURAL HERITAGE (ITABC)

The ITABC was created in 1981 and is headquartered in CNR's Research Area Rome 1, where it has confirmed to be the first (at least temporally) leading center in the field of research on Sciences and Technologies for Cultural Heritage.

The vision that characterizes the conceptual foundation and the operative premise of the Institute, interprets Cultural Heritage as a benchmark for collective identity at local, regional, national, European, international level, contextualized in the territory and read into the light of multiple knowledge and expertise, therefore, as a potential booster of social, economic and cultural dynamics, such to suggest a unitary systemic approach.

The "Cultural Heritage Ecosystem" has therefore been considered as a complex system of interactions between different types of processes (knowledge, monitoring, preservation and valorization-fruiting) operating within a network of different types of Cultural Heritage and related contexts. Based on these principles, the Institute's main objectives consist of designing innovative solutions for managing such interactions through heavily coordinated research actions, as well as by experimenting and disseminating results based on a complex and integrated system of enabling technologies, innovative in terms of state of the art, internationally.

In particular, a significant part of the activities of ITABC is devoted to training, funded at national and international level, seen as a dissemination of the research results produced by it and aimed at building new and specific professionals in the field of Cultural Heritage.

The interdisciplinary vocation, expressed in a vision of "unicum", the ability to act as a model and a privileged contact point for scientists, public administrations, universities, research and training centers representing the European and international landscape, give the Institute the chance to specialize in complex and diversified activities in areas ranging from territory to architecture, from single artifacts, to characterization of finds' matter, from Archaeology to museum.

In its role of Europe's leading player in the various frameworks that have evolved over the time, surely today ITABC is at the core of the debate that is being developed within the Horizon2020-oriented initiatives, without losing the Mediterranean vocation, vice versa acting as a bridge for a continuous intercultural exchange.

<http://www.itabc.cnr.it>

Chapter 3

Course 1

Environment/Climate Change/Resilience with particular reference to the Mediterranean Area

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The course “Ambiente e cambiamenti climatici” was developed in the context of the analysis and mitigation of impacts related to climate change in the Mediterranean area. The course integrates the strategies at National and International level such as the Climate-Joint Programming Initiative of the European Climate Research Alliance, Group on Earth Observations. The course was structured in 140 hours of frontal teaching and an intensive practical phase of three months. The course was carried out in three Institutes in different sites: ISAC-CNR in Rome Tor Vergata, IRPI in Bari, IGG in Pisa.

Each Institute has a diverse know-how (in a nutshell: Climate, hydrogeology, Ressources) and such diversity was – at the end - a clear plus for the trainees.

3.1 Course 1 Coordinator, Objectives and Results

FEDERICO FIERLI

Course 1 coordinator



BIOSKETCH

I was born in Rome, studied, worked and lived in Paris, Nice, Boulder (CO, USA), Bologna. I am a researcher at CNR since 2002 and Associate professor of Climate Physics since 2004 at the University of Rome. I study physical processes for Earth Climate, focusing on the interplay between the composition of the atmosphere and the transport at various scales. I worked on the state of the climate in distant regions (Poles, Tropics, South-East Asia) where changes can occur abruptly. Besides that, I try to sail, hike and enjoy with my family.

COURSE OBJECTIVES

The course had the overall objective to provide know-how and tools on:

- Climate risk evaluation
- Environmental risk management (pollution, climate)
- Monitoring systems
- Widen the accessibility to know-how

The course hence focused on the identification of changes, impacts, definition of the risks and methodologies of analysis, based on observations and numerical models

The frontal courses program included three main themes:

- Climate Processes, Meteorology, Pollution, Remote Sensing, Predictability, Marine circulation with focus on Mediterranean area made by 7 teachers from ISAC-CNR

- *Hydrogeological risk, hydric resources, remote sensing for landslides and hydrology, landslides risk from IRPI*
- *Acquifer systems dynamics, isotopic hydrology, geothermy, emissions, CO2 reduction systems, waste stocking systems*

The practical part, given that trainees were hosted in different towns and thanks to their strong background (all of them already holding a PhD), was structured to provide to each trainee a different personal research topic, close to their objectives, to maximize the interest and potential impact. Two common events were held and internal scientific exchanges took place.

RESULTS

The course was attended by 9 trainees from Egypt, Tunisia, Albania, Lebanon and most of them demonstrated a great interest and motivation. Due to the geographical distribution, the lessons were given by videoconferencing. The set-up was at the end quite long but we were able to provide all the planned courses as reported in the program. The pdf of the presentations was also provided to the trainees.

After the first phase, we provided a test to verify the learning process for the frontal courses, consisting of 10 questions with 1 page answers on selected topics. 8 out of 9 of trainees provided their personal answers.

In April we held 2 round-table meetings (in video-conference) to perform a wash-up of the theoretical part of the course and present the chosen practical stage.



Figure 3.1: IGG Landfill site visit, Picture from Iris Bakiri

In June the trainees attended the Course on European Projects at CNR Headquarters and subsequently attended a visit at a waste treatment site organized by IGG (see picture). Trainees also took the opportunity to build

exchanges with other components of the course (i.e. Mohammed Hassan from IRPI to ISAC, Yassmina Hesham to ISAC Bologna and ICTP and IBIMET).

We refer to the single reports to have an overview of the practical stages, that were clearly the key part of the course. This is demonstrated by an average high level of commitment with the attendance, in some cases, of interesting scientific results. An example is the analysis of Climate projection uncertainties and implication for climate extremes and agricultural indices for which an example is reported in Figure 3.2.

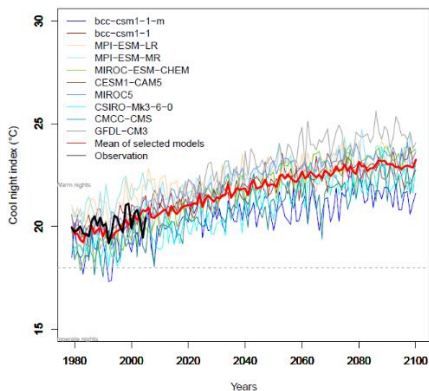


Figure 3.2: CMIP5 GCMs ranked according to root mean square error score (left), the future projection mean cold night index over the domain 18W-40°E, 18N-50°N (right) – Plots by Anis Zammel and Yassmina Hesham

Trainees also took the opportunity to build exchanges with other components of the course (i.e. Mohammed Hassan from IRPI to ISAC, Yassmina Hesham to ISAC Bologna and ICTP and IBIMET).

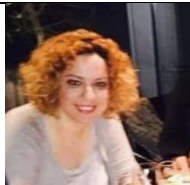
Additional positive feedback can be seen by the preparation of bilateral projects and conventions during the course by the trainees and their tutors (i.e. ISAC-CNR with NIOP, Bilateral agreement between ISAC-CNR and CLAC).

Acknowledgments: The course 1 is the result of team working with ISAC, IRPI and IGG colleagues who supported the implementation, gave very interesting and accurate lessons, supported the trainees in all practical activities. Special mention should be given to IGG and IRPI representatives: PierNicola Lollino, Francesca Ardizzone and Brunella Raco.

3.2 Course 1 Fellows

IRIS BAKIRI

Albania



BIOSKETCH

Iris Bakiri has done her university studies in the field of Chemistry. She is currently serving as a researcher/lecturer at the Institute of Applied Nuclear Physics, University of Tirana, Albania. Her work is centered on radiocarbon dating of archaeological samples and measurements of the stable isotopes, mainly deuterium and oxygen-18, in water samples. She is author and coauthor of several papers.

Why I have applied for Diplomazia2 and expectations

The first thing that crossed my mind was that I wanted to improve my knowledge on environment and climate change. I saw it as a good opportunity to learn more and to merge these knowledges with my actual job. I thought that it would be a potential way to find a new look at the interconnection between water and climate changes. Meanwhile, I read the Call once more and noticed the participating institutes. It was a good chance to see how a big research center like CNR functions, what kind of measurements are performed and how CNR colleagues deal with them. This expectations were definitely met during my internship. Furthermore, it was a good way to learn from others' experience and to find a way to collaborate through projects with my Italian colleagues. There is so much to do about this topic.

My experience as Diplomazia2 Fellow

The Diplomazia2 multidisciplinary training course was divided into two parts. The first part was only theoretical. It lasted 6 weeks and it was divided into three subparts of two weeks each. The first day was mostly dedicated to the introduction of the fellows who had the opportunity to be part of Diplomazia2. Dr. Federico Fierli, on behalf of the National Research Council (CNR), introduced himself as the coordinator of the first course "Environment/Climate Changes/Resilience" with particular emphasis on the Mediterranean Area. He presented the CNR responsible structures for the implementation of this course: IGG, IRPI. Furthermore, he outlined the aims

of this multidisciplinary course in his welcome speech. All the research institutes' representatives described their institutions and the work that is currently being carried out within each of them.

The first subpart consisted in lessons concerning Climate projections and impacts of climate change; Weather models; Remote sensing of precipitation from space; Chemistry in the Mediterranean Region. These lessons were held by ISAC. The next two weeks were devoted to the lessons from the colleagues of the IGG- Pisa. The main topics were about climate, GIS, carbon cycle, geochemistry, aquifers and how to deal with the collected data from different aquatic systems. The lessons from IRPI were held during the month of April and the goal of these lessons was to give us information concerning landslide monitoring, GIS, SAR interferometry - geomorphological processes, hydro-morphology and the last lessons talked about coastal aquifer: from theory to practice. During this period, we had the opportunity to visit the laboratories of IGG and to have a better look on the techniques used by scientists working in this Institute. The lessons were followed by the fellows' presentations describing the main topics explained during these weeks. My presentation was about isotope hydrology, which was explained by the colleagues of IGG. At the end of the lessons a specific evaluation for each part of the course was carried out.

The second part of the training course was focused on the internship. We were offered to choose between five themes of internships. The internship I chose was entitled: "Integrate water Isotopes into hydrogeological studies for developing groundwater models and understanding mechanisms of contaminations from seawater intrusion and landfill leachate: the case study of the Pisa Plain aquifer system (W-Tuscany)" with mentoring of Dr. Matia Menichini from IGG.

Co-operators (IGG) were Dr. Marco Doveri, Dr. Giulio Masetti, Dr. Brunella Raco, Dr. Simone Da Prato, Dr. Francesco Norelli, Sandra Trifirò, Enrico Calvi.

This area has already been studied by many researchers (Baldacci et al 1994; Rossi and Spandre 1994; Grassi and Rossi 1996; SPANDRE et al, 1999; FRONDINI et al, 2001; GRASSI & CORTECCI, 2005; Doveri et al 2010; Butteri et al 2010). The Pisa plain originates from the filling of the southern part of a wide tectonic depression, bordered by the Pisan Mountains to the east and the Pisan Hills to the south. The oldest formations in the area can be found on the Pisan Mountains and are represented by phyllites and quartzites (Palaeozoic-Trias), carbonates (Mesozoic), terrigenous formations (Cretaceous-Oligocene) of the Tuscan sequence and flysch formations (Cretaceous-Eocene) of the Ligurian sequence (Grassi and Cortecchi 2010). The multilayered confined aquifer system of this area is an important and strategic resource for the area,

because it provides a substantial volume of water in order to satisfy the request of the agricultural and zootechnical firms, tourist structures (in particular bathing establishments), and the drinking use. The coastal aquifer salinization was analyzed by means of a multidisciplinary approach: integration of the hydrostratigraphic knowledge, verification of the piezometric conditions, measurements of chemical characteristics and isotopic contents of the water sampled in different years (Butteri et al.2010).

The data were collected in older sampling campaigns and from continuous monitoring stations. The data consisted of a great quantity of stratigraphic, hydrogeological, geochemical and isotopic measurements and they were organized in a specific geodatabase.

Subsequently, the data available were used to reconstruct the geometry of aquifer system, in order to understand the hydrodynamic and identify the main processes that occur in the aquifer system.

In order to get acquainted with the study area, it was organized a sampling campaign at Migliarino, San Rossore, Massaciuccoli Regional Park, which is sited on the coastal area of the Pisa plain. During the sampling survey were performed measurements in situ of the piezometric levels, pH, electric conductivity, temperature. Samples were also gathered to determine isotopic ratios and chemical characteristics in well/piezometers and in the main streams. The sampling was performed in different depths to investigate the evolution of the seawater intrusion in this area (seawater intrusion is a natural phenomenon that allows the encroachment of saline water into aquifers).

Other field activities

The internship included a phase of field activities for the measurement of some hydrogeological and physical-chemical parameter, water sampling, well vertical logs, etc. In this context, Dr Marco Doveri and Dr Matia Menichini organized a continuous sampling survey at Maresca, located in Pistoia, Tuscany, Central Italy, at an altitude of 790 meters above the sea level. There were five fixed sampling points. There were performed tests to determine the flow rate and water level of the streams, pH, temperature, electrical conductivity and collected samples for measurements of stable isotopes ratios in each point.

May 2017, Visit to Legoli landfill. The visit was organized by Dr. Brunella Raco. Legoli landfill is located in Val d'Era Graben in Peccioli municipality, province of Pisa in Central Tuscany. The surface of the landfill is nearly 140000m² and a clay formation with a permeability of about 9-10 cms⁻¹ constitutes the

impervious substrate. This landfill is continuously monitored by IGG for soil gas emission.

Events:

March 2017: Project management as a distinctive competency of European funding projects. The goal of this event was the growth of the project management culture within the projects funded by the European Union.

May 2017: Short Course on Isotope Hydrology organized by Institute of Geosciences and Earth Resources (IGG), Pisa, Tuscany, Italy. This course aimed to affirm the main principles of isotope hydrology and its applications on the study of aquatic systems, water resource management and human impact on water quality.

May 2017: “Life program open day: Green pathways to sustainable use of resources” held at the University of Milan, Milan, Lombardy, Italy. The objectives of this event were to show the benefits that Life program has brought to research and to the implementation of environmental policies; to disseminate results of LIFE funded research projects to the different stakeholders and demonstrate their benefits for the society and the environment; promote networking initiatives among LIFE projects.

May 2017: “Biodiversity for ecologically based resilience to climate change in agricultural systems” organized by Dipartimento di Scienze Agrarie, Alimentari e Ambientali, Università degli Studi di Perugia, in Perugia, Umbria, Italy. The main goal of this event was to discuss how the climate change affects the agro-eco-systems. Umbria represents a suitable area for the development of integrated agro-system approach.

The ecological connection makes the territorial systems more resilient, helping to preserve biodiversity and to combat climate change, but the correct interpretation and ecological management of agro-ecosystems helps to keep them alive.

June 2017: Horizon2020 Training Days on European Institutions and European research programs strategies, 6-7 June 2017, in Rome, CNR headquarters. To support the Horizon 2020 strategy (smart, sustainable and inclusive growth) the European Union has been funding for many years research and innovation in Europe with both direct and indirect funds. This led to the launching of various proposal calls covering all sectors: research, agriculture, security, energy, transport, information technology, telecommunications, health, biology, etc. Horizon 2020 is helping to achieve this by coupling research to innovation and focusing on three key areas: excellent science, industrial leadership and societal challenges. The goal is to

ensure Europe produces world-class science and technology that drives economic growth.

June 2017: GIT 2017, XII Convegno Nazionale del Gruppo di Geoscience e Tecnologie Informatiche Sezione della Società Geologica Italiana, Parco Nazionale delle Colline Metallifere Grossetane, Gavorrano, Tuscany, Italy. The goal of this congress was to gather people that use Information and Communication Technology as a tool for collecting, analyzing, processing and integrating, managing and disseminating geo-environmental data.



Figure 3.3: Maresca sampling campaign



Figure 3.4: a) Hydrasleeve used for water sampling in depth b) Measuring Electric Conductivity, pH, Temperature in situ

How diplomazia2 can improve my future perspectives

The benefits and opportunities that Diplomazia2 multidisciplinary training program creates are several.

Lifelong learning is indispensable to move ahead in career. It confirmed that I am committed to my professional development. Participating in this multidisciplinary training program was also a good opportunity to develop networks and contacts that will be useful –due to the critical insights and new ways of thinking that people involved in the Diplomazia2, provided. It was about thinking differently and revitalizing the passion on doing research. Research is moving towards international endeavors. Effective collaboration between researchers from different countries is necessary to maximize the potential benefits of future research activities. Research collaboration would

provide substantial benefits to scientists, specialists and policy makers. It represented a good opportunity to build a bridge for future joint research projects with my Italian colleagues.



BIOSKETCH

Born on 6th of May 1989, I spent all my childhood in Sohmor, my little village in Lebanon.

I made all my studies including my university studies in my country. In 2012, I was granted a PhD scholarship for excellence from a Lebanese association. So, I finished a PhD in Earth and Environmental Sciences at the Lebanese University (Lebanon) and Limoges University (France) in 2015. During this period, I acquired a lot of expertise and a deep experience in my domain. Now, I am a fellowship student of Diplomazia2 training program at CNR-IGG in Pisa.

Passionate by nature, I like to walk in the forests, or close to the sea. I spent a long time in this activity. Patience is one of my best qualities which helped me achieve many goals in life.

Why I have applied for a fellowship within Diplomazia2 and expectations

The first time I heard about Diplomazia2 was from a colleague of mine working in a meteorological station. She knows about my expertise, and that I had already finished my PhD thesis. So, she thought that this opportunity could be a good step for my career.

I saw the title of the courses, and felt that the first course entitled: “Environment/climate change/resilience with particular attention to the Mediterranean area” would be fit for me. Therefore, the first reason why I have applied for Diplomazia2 grant, is because I felt I have all the necessary qualifications, qualities and skills to be a successful candidate for this course and also because the course could enlarge my expertise and further strengthen my background in the environment domain. I believed that this course could help me develop the skills I already have and acquire new ones. In fact, I would like to add skills through the

training, grow professionally and advance in my career after my PhD thesis.

Another important reason that encouraged me to apply is that this training program is organized by a very well-known research center in Europe, the National Research Council of Italy (CNR). In fact, it is a precious opportunity to have a training coordinated by CNR. I felt that this training will give a significant contribution to my career as well as fulfill my potential.

My experience as a Diplomazia2 Fellowship holder

As previously mentioned, I was dispatched to the first course of Diplomazia2 entitled: “Impact of climate change on the environment and especially, in the Mediterranean area”. This training was divided into two different parts: a theoretical one, and a practical one.

The training began with lessons to be attended for 2 months (theoretical part). These lessons were organized by the **IGG-Pisa**, **ISAC-Rome**, and the **IRPI-Bari**. During these first 2 months, we have acquired a lot of expertise, information and new skills in many domains related to the environment. In addition we have built professional relations with many scholars from the three different institutes.

After the first theoretical part, we began the practical one. During this part, I received a training related to the environmental impact assessment of a landfill on groundwater and atmosphere. I have acquired a deep knowledge and new skills in the management of a landfill data. A knowledge of many softwares as Grapher 11, Statistica, and Pro UCI used to handle such data, has been acquired too. To reinforce our internship, a trip to Legolli landfill was organized by the institute I have been assigned to IGG. This trip was very informative because it taught us how to manage a landfill as of its construction until its closing and even afterwards.

And, of course, we cannot forget the workshops we have attended:

- 2-4 May Workshop was entitled: “Application of Earth Observation tools in Protected Areas in Europe and beyond, establishing a community of practice one” organized by IGG

within the project Ecopotential Horizon 2020, in Pisa. Field trip inside the Natural Park: San Rossore reserve or Massaciuccoli Lake in Pisa closed this meeting.

- 24 May Workshop focused on stable isotopes entitled: “What are they for?” organized by IGG in Pisa.
- 6-7 June Workshop in Rome entitled: “Training Days on European Institutions and European research programs strategies”. This event was very interesting and provided information on the latest EU Calls for projects, scholarships and how to design and submit a project.
- 4-5 July Training on ArcGIS organized by IRPI in Bari.

As a result of these activities, the most important consequence is the relations that we have built with other professors and students we met from the other institutes involved in the project. A further consequence is that we were enriched by a great deal of information and could enlarge our expertise.

Briefly, this training was so interesting that I would surely encourage other students to apply for this program. I can consider it as a good first step for a young researcher who has already finished a PhD like me. A lot of doors could open for a career, but I will discuss this issue more in detail in the next question. The student’s performance will improve, while motivation and innovation will increase. Finally, a training experience such as the one provided by Diplomazia2, even though does not eliminate the need for supervision, it reduces the need for detailed and constant supervision, making the trainee more responsible for his/her decisions, and capable of working more independently compared to a PhD experience.

What can I say about my experience in Italy? One word which summarizes it: “Amazing”.

On the 20th of February, my trip began. I was very nervous. I was looking forward to starting. I was a little afraid because I didn’t know what I would find, and most of all, I had big expectations about this experience, which have been significantly outnumbered.

In our training course, also fellowship holders from Albania, participated. From the outset, the good vibes were present among all

participants, who soon became friends. That friendship made us feel like we were home and we didn't want to leave. The food was really good and surprisingly, I barely ate pasta and pizza.

Regarding the activities for spare time, they were numerous: from small theatres, to excursions to Rome, Siena, Livorno, Bari, Napoli... Everything was ruled by a really nice staff that put much effort in making us all feel well integrated and enjoy the experience.

But doubtless, the best moments I've had, are in Pisa (my home residence in Italy). Pisa tower visit and the Luminaria event. This latter was on June 16th, at night. All the buildings around Arno River, were lighted by candles, and at midnight a party of fireworks was organized. It was a fantastic event.

In short, my experience in Italy was not only fun, but it was very enriching. I have learned a lot of things from other countries as much as from ourselves and how we are judged by the outside. We have been able to practice English and to visit extraordinary places and the best thing is that we have made many friends from different countries. In addition, I have learned Italian language; a new skill added to my CV. Consequently, I encourage everyone who dares face a training program to decide to apply, because it is an experience really worth living. I would repeat this experience, no doubt.



Figure 3.6: Field trip to Legolli landfill



Figure 3.5: Ecopotential workshop meeting in Parco San Rossore-Pisa

How diplomazia2 can improve my future outlook

Diplomazia2 was a good first step in my career. During this training, I was able to build a network of contacts who can help, give me advice and/or information now and in the future.

It was a good opportunity for me to design two projects with professors from the IGG Institute. The first one will be considered as a post doc, if we obtain the scholarship for it and will help me acquire new skills and expertise in my domain as a biologist. It will provide me with more experience in research also through the chance I will be given to meet other researchers and participate in many workshops and conferences.

The second is a bilateral project between CNR-ITALY and CNRS-LEBANON. This project will be considered as a first step for a collaboration between the Lebanese university and the Institute of Geosciences and earth Resources in Pisa-Italy. So, Diplomazia2 has opened, not only for me, channels of collaboration, building relations between the professors from Italy and those from Lebanon. In this case, a real exchange of information and knowledge between the two teams will be accomplished. So, this networking, with the ultimate goal of establishing connections and relationships, will advance my professional career.

In addition, it is well known that a **training background adds a major significance** when attempting to enter the job market. It also helps gain more confidence, necessary especially in case of a phone or in-person job interview. So, diplomazia2 has shaped my personality by making me more confident and responsible for my decisions.

In conclusion, Diplomazia2 experience is *“a good way to acquire relevant knowledge, skills, and experience while building important connections in the field”*.



BIOSKETCH

I graduated successfully in 2003 as an Industrial chemist. In 2009, I finished my postgraduate studies at the Faculty of Natural Sciences. In 2015, I finished my doctoral studies in water treatment.

After my graduation, I have worked for eight years as a chemical engineer (Quality Control) in the laboratory of the brewery “Stefani &Co” company.

Since 2009, I am a lecturer of chemistry at the Polytechnic University of Tirana. During my daily work, I like to teach and give my students all the information I have in order to increase their knowledge and skills. I am also involved in research work. My fields of research are environmental impact, water quality, water treatment.

Friend of environment, I like hiking on the mountains or swimming in the sea. I also like extreme sports such as parachuting or skydiving.

Why I have applied for Diplomazia2 and expectations

Diplomazia2 was a very good opportunity for me. I have received the notification with the best timing for what my professional and personal situation is concerned. I learned about Diplomazia2 from one of my colleagues at work and I had the maximum support from my coworkers and the head of chemistry department at the Polytechnic University of Tirana (UPT). I applied for this program because some of the topics proposed by the courses were new for me.

Furthermore, the training was divided into two parts theoretical and practical which were both important to the progress of my professional career. Another strong reason to apply without any hesitation is that the course was organized by one of the best scientific research institutions (CNR) not only in Italy but also internationally. It was my first experience, since long. In addition, the exchange of experience with colleagues from different countries was another reason. The last one is for the creation of a professional network in order to have further collaborations with scientific researchers not only from CNR but also from other institutions of the Mediterranean region. It was a good chance

for me to be a part of IGG (Pisa) since the knowledge and experience I received by this Institute will help me a lot in the future, by improving my quality as a teacher of geo-chemistry.

My experience as Diplomazia2 Fellow

During diplomazia2 training, I participated in a lot of activities listed as follows:

Lectures that we attended during the first two months as of the beginning of the training (Theoretical part).

I took part in the course developed by IGG-Pisa XV “Corso Idrologia Isotopica”.

I participated in a field trip in Pistoia area for water sampling in some small springs, and flow measurement in a small river.

I participated in the workshop held in IGG-Pisa about Stable Isotopes entitled: “What are they for?”

I participated in a seminar held at the University of Milan entitled: “Live Program Open Day: Green Pathways to Sustainable Use of Resources”

I participated in “Diplomazia2 Horizon2020: Training Days on European Research Programs Strategies”.

I participated in a field trip visit to Legolli Landfill, to see how it is managed from its construction to its closing.

I participated in the XII National Conference of Geoscience and Information Technologies Sections of the Italian Geological Society (GIT) in Gavorrano.

I followed a training on ArcGIS organized by IRPI in Bari.

For the practical part, I made a training related to the environmental monitoring of a landfill on groundwater and atmosphere. During this training, I have acquired a lot of expertise and new skills in handling and managing the data related to environment. I have learned new specific software for analyzing this type of data such as Grapher 11, Statistica, Pro UCL, Arc GIS...

This training program helped me increase my creativity by implementing new ideas and my interpersonal skills by undertaking collaborations with researchers and other colleagues from Mediterranean countries. It enabled me to work with people at all levels, motivated others and changed people's attitudes when necessary (teamwork skills). In addition, it further increased

my speaking and communication skills. My background has improved during this time through the intake of a great deal of information in different fields.

What about my whole experience in Italy?

I really feel blessed beyond words. Being in a place where I had been during my childhood for just two weeks, is like a wonderful memory that has fallen asleep for several years. I can't wait to come back again after this training.

The food was really good especially pasta and pizza. In addition, I visited many Italian cities: Rome, Milano, Florence, Follonica, Livorno, La Spezia... In all these cities, I visited a lot of museums, monuments... I loved seeing the historical sites in Rome and visiting Vatican City. St. Peter's was absolutely amazing. The Duomo di Firenze was a very beautiful place I have visited. Briefly, the Italian heritage is very rich by its arts, architecture, monuments...

But one of the loveliest city for me was Pisa. During this period, the most **astonishing** event was the Luminaria di Pisa, with 50,000 people in the streets celebrating with candles in every window and a fireworks show like I had never seen.



Figure 3.7: A sampling day in Pistoia



Figure 3.8: landfill trip in Legolli

How diplomazia2 can improve my future perspectives

Diplomazia2 was a good opportunity to me from a professional viewpoint. It improved my knowledge and skills in the field of geo-chemistry, by enriching my background with new information that could be helpful in my daily work.

During this training, I developed my professional network by building relations with researchers not only from CNR but also from outside Italy

(Lebanon, Egypt, Tunisia...). This network will help me open new possible collaborations, in the near future.

In addition, from this training, I had the opportunity to plan for a possible bilateral project between IGG and Polytechnic University of Tirana, my affiliation institution. In this case, an exchange of information and skills between the two parties involved in the project, will be planned. So, I think such joint research program will boost my professional career by importing new collaboration to my university.

In conclusion, this training program is a good experience for acquiring not only new knowledge, expertise and skills but also to build important relations with many researchers, useful at present and for the future.

ALIA AMER

Egypt



BIOSKETCH

My name is Alia Amer. I got all my graduations (BSc, MSc and PhD) in Egypt from the Faculty of Agriculture, Cairo University.

I joined ARC as Assistant researcher since 2008 to date. During that time, I participated in implementing the research program of the aromatic section. Now, I am a researcher in the same section, working with interdisciplinary teams from various institutes such as Water Research as well as Central laboratory for agricultural climate. The aim is to develop a joint research program in order to face the agriculture problems in Egypt. Therefore, during this period, I have acquired a lot of expertise and a deep experience in my domain. Now, I am a fellowship student of Diplomazia2 training program hosted by IRPI in Bari.

One of my best hobbies is to play tennis. I spent plenty of time doing this sport, reading books and travelling. I am methodical person, calm, patient reliable and sociable.

Why I have applied for Diplomazia2 and expectations

I learned about Diplomazia2 at my work place - the Agricultural Research center. It is to be pointed out that, nowadays Egypt and worldwide, climate change has the potential to affect agriculture through changes in temperature, rainfall timing and quantity, CO₂, and solar radiation. So, I thought that the course: “Environment/climate change/resilience with particular attention to the Mediterranean area”, could be useful to me by gaining new practical approaches, qualities and skills such as acquiring new knowledge, writing good research proposals or grant proposals for funding, leading teamwork on new scientific research. Being involved in different training programs related to the climate change, this program could give me the opportunity to enlarge my professional experience, competencies and to further fortify my background on climate change phenomena.

Another important reason that encouraged me to apply is that this training program is organized by the National Research Council of Italy (CNR). In fact,

I thought that this training will give a significant contribution to my career. Finally, applying for this course will increase my skills on international cooperation, cross-cultural relations and communication, as I am a very sociable person.

My experience as Diplomazia2 Fellow

My training was divided into two different parts: a theoretical one and a practical one.

The theoretical part of my Diplomazia2 Fellowship lasted 2 months during which I attended several lectures. These lectures were organized by IGG-Pisa, ISAC-Rome and IRPI-Bari. Within these 2 months of lectures, I have acquired a lot of competencies, information and new skills in many domains related to the environment and climate change.

The practical part of the fellowship concerned both laboratory and field activities, also including data elaboration.

As concerns the laboratory activities, firstly, I have performed many laboratory testings on groundwater samples at the Hydraulic Laboratory of the Bari Section of IRPI. Among them, I did some sample trials on Ion chromatography in order to measure the concentrations of major anions (such as fluoride, chloride, nitrate, nitrite, and sulphate) as well as major cations (such as lithium, sodium, ammonium, potassium, calcium and magnesium). In addition, I have done some water physico-chemical analysis including the measure of Total Dissolved Solids (TDS), which corresponds to the determination of the total amount of mobile charged ions, including minerals, salts or metals dissolved in a given volume of water. TDS is directly related to the purity of water and the quality of water purification systems and affects everything that is consumed, lives in, or uses water, whether organic or inorganic, whether for better or for worse. In addition, I took pH and titration measures for some groundwater samples to determine the acidity or basic qualities of water.



Figure 3.9: IRPI Laboratory

With reference to the field activities, I performed a training related to the Landslide Mitigation by using vegetation cover, in order to increase the evapotranspiration rate for decreasing the soil water content and water rainfall pressure within the soil unstable slopes.

Therefore, I have acquired a deep knowledge and new skills in the management of landslides. After having studied some scientific papers and documents on this topic, I participated in some field testing on Pisciole and Pianello landslides, during which I learned how to measure both piezometric levels within a slope (piezometric monitoring) and deep soil displacements (inclinometer monitoring). As concerns the Pisciole landslide slope, an in-situ experiment already settled into the slope (vegetation implant). This implant was realized for understanding the effects on the piezometric state of this unstable slope. Therefore, besides the geotechnical monitoring (piezometric and inclinometric in-situ measuring), my field training aimed at looking after the vegetation implant, for instance to understand: How are the plants growing up in this slope? How to measure the pore water pressures within the slope (piezometric monitoring)?

Moreover, I elaborated all the piezometric data collected in the field. In addition, rainfall data (daily, monthly, total rainfall, cumulative rainfall, net rainfall) including also the evaporation-evapotranspiration input into the climatic regime of the area where the Pisciole and Pianello landslide occurred, were analysed and elaborated by using some statistic methods in excel sheet models.



Figure 3.10: Field Activities

All the activities (field monitoring and data analysis) that I carried out during these months are important actions within a research project between IRPI-CNR and the Technical University of Bari (POLIBA). This project is aimed to understand the slope – atmosphere interaction with clayey slopes affected by slow-moving landsliding.

Moreover, I attended a field trip with IGG Pisa to Legolli landfill to see how it is monitored and managed as of its construction until its closing. In fact, one of the major climate change problems is the increasing greenhouse gases emission in the air including from the landfill. That is why, we need to find tools to reduce and manage the landfilling of municipal domestic waste MSW we create.

Also, IRPI Staff was very helpful as they arranged a short training on ArcGis and QGis to gain knowledge and learn more about these software programs. Actually this training was very useful to me. Using GIS tools will help me carry out more research work.

And of course, we cannot forget the workshops and conference which we attended:

- 6-7 June Workshop in Rome entitled: “Training Days on European Institutions and European research programs strategies”. It was very interesting and let us know the latest Calls for projects, scholarships and how to write and submit a project.
- 28-30 June conference in Pisa entitled: “XV CONGRESS OF THE ITALIAN SOCIETY OF PHYTOCHEMISTRY JOINTLY WITH 1st International Congress on Edible, Medicinal and Aromatic Plants (ICEMAP 2017)”. It was useful to understand the situation of medicinal plants as an important field in agriculture and how climate change is affecting these plants in particular.

One of the most important consequence of this training is the relations that I have built with other professors and students from other institutes. In addition, it provided us with a great deal of information and enlarged our competencies.

Moreover, I believe that this program will contribute to develop international research and collaboration between Italy and Egypt and other countries. In this way, acquiring new scientific knowledge and increasing my international collaborations and publications will improve my research career in ARC.

Also, the most wonderful gain from Diplomazia2 in Italy was that I have had a lot of experiences dealing with new multinational friends: Italian, Lebanese, Tunisian, Albanian, Hungarian, and also, special friends from my country Egypt. I have very nice memories of them all. Until now and while writing this report, I visited many cities in Italy with some friends met during the Diplomazia2 Fellowship program. I started with Puglia region (Polignano a mare, Lecce, Conversano, Trani, Alberobello, Matera and Ostuni) and then I went to the north. We started with Napoli, with the amazing cities of Pompei and Sorrento. Also we visited Florence, Pisa, Cinque Terre. And we will not forget the Capital of Italy the famous “Rome”. Actually, every city has its history. Every city has its own aesthetic views. The food was really good and surprisingly, I barely ate pasta and pizza.

In the next days, we are planning to visit Gargano, Grotte di Castellana, and make a little trip to the North of Italy including Venice, Milano and Genoa...

But, the loveliest city in Italy was my home residence: Bari. I really enjoyed my 6 months stay in this city. It was near the sea where I spent plenty of time walking at the end of the day. I went to visit the Basilica of Saint Nicholas, and its cathedral.



Figure 3.11: Some pictures in Italy

How diplomazia2 can improve my future perspectives

Diplomazia2 was a good and rich experience full of information and knowledge. It helped me build a new channel of cooperation between Italy and Egypt, and especially between CNR-IRPI and my center of research ARC.

One of the perspectives of Diplomazia2 program is to extend this training for a couple of months in order to continue our internship about mitigation of landslide using vegetation cover. In this case, I will further improve my background (evaporation-evapotranspiration input into the climatic regime) by acquiring new statistical models and GIS tools.

Another perspective is to design a bilateral project between CNR-ITALY and ASRT-Egypt. This joint research project would be a first step of collaboration between the two countries in this field. In this way, a first and real exchange of information and knowledge could be done. From my side, this possible project could boost my professional career.

In one sentence, Diplomazia2 experience is ***“a useful tool to gain multidisciplinary knowledge, new skills and establishing a new professional network”***.

ERIONA CANGA

Albania



BIOSKETCH

Eriona Canga is graduated in Environmental Science and Technologies. She holds a PhD from Aarhus University (Denmark), MSc and BSc degrees from Padua University (Italy). Since 2009 her research work is focused on municipal wastewater and agricultural drainage water treatment from nitrogen and phosphorus, by using innovative filter materials and treatment technologies (Constructed Wetlands, drainage well filters). Her competences are in:

- Environmental pollution and remediation
- Sustainable environmental eco-technologies
- Wastewater and drainage water treatment
- Phosphorus and nitrogen removal by reactive filter materials
- Tracer transport and hydro-geochemistry aspects of CW.

My motto: Reduce-Reuse-Recycle.

Hobbies: Literature, writing, photographing, hiking, travelling.

Why I have applied for Diplomazia2 and expectations

Future challenges about climate change and environmental pollution of the Mediterranean area need a synchronized and collaborative response of the affected countries. I see Diplomazia2 as a good opportunity to gather researchers from different backgrounds and countries to discuss all these issues and to plan joined actions (bilateral projects, conferences, awareness, etc.).

I have applied for Course 1 “Environment, Climate Change, Resilience with particular reference in the Mediterranean area” of Diplomazia2 for two reasons: 1) networking with CNR colleagues and course participants for future projects about Mediterranean area; 2) the multi-disciplinary training course may bring up new ideas and inter-disciplinary collaborations. My expectations were to learn something new and to do research work; the first expectation was met satisfactory while the second was not expected from the course.

My experience as Diplomazia2 Fellow

The Course 1 of Diplomazia2 was structured in two parts, theoretical and practical.

Theoretical Part

The first part consisted of frontal/skype lessons (28 February-11 April 2017) organized by several institutes of the National Research Council (CNR) of Italy: ISAC-Rome), IGG-Pisa and IRPI-Bari. The topics discussed were multidisciplinary (Figure 3.12) covering topics such as: Atmosphere (weather forecast, climate change, air pollution), Soil science (geology, landslides), Water (Rainfall, flooding), Groundwater (seawater intrusion in coastal aquifers, management approaches and vulnerability risk assessment methods), Stable isotopes for hydrology, environmental pollution. Every subject has interaction with modelling as a powerful tool to predict future scenarios or analyze dataset and visualize them in maps for example. Models and numerical models with applications to different subjects as well as to different scales (local, regional, global), were presented.

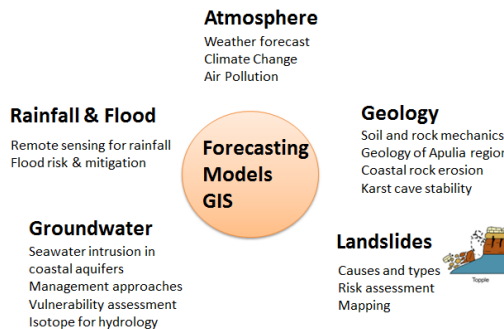


Figure 3.12: Schematic representation of the topics discussed during the frontal lectures of Course 1 – Diplomazia2

Two subjects from the frontal lessons discussed my field of interest:

“Groundwater pollution” lectured by Dr. Maurizio Polemio (IRPI, Bari).

“Environmental impact of waste management facility” – this lesson was attached to an in-situ visit of a landfill area (Legolli) in Tuscany. This visit was interesting as we were able to see all three life-stages of a landfill: in construction, under operation,

and a closed landfill. The visit was organized by Dr. Brunella Raco of IGG, Pisa, which I would like to thank for making it possible.



Figure 3.13: Legoli ecological landfill, Tuscany, Italy (8 June 2017)

Practical Part

The second part was carried out at “Istituto di Ricerca per la Protezione Idrogeologica, IRPI” CNR, Bari where I was part of the groundwater research team. The practical part consisted of:

Analyses of groundwater samples (Ion Chromatography, Titration, Total Dissolved Solids)

Literature review of a case study in Conversano landfill, which objective was to find out the pollution source (landfill or agriculture) of highly NO_3 concentrations found in groundwater.

I started to construct a geodatabase of karstic aquifers in Apulia region and Albania using QGIS software.

Technical skills acquired:

- Dionex ICS-1100 Ion Chromatography System. I learned how to use the

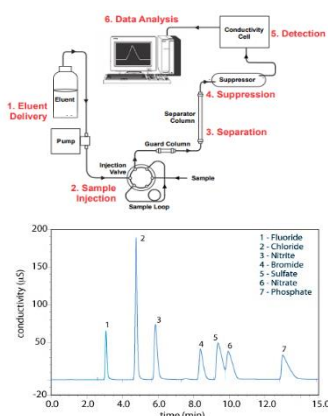


Figure 3.14: a) Ion Analysis Process; b) Sample concentration results

system and performed few cation and anion analyses of groundwater samples. The IC system consists of six stages represented in (Figure 3.14a). Before running a sample, IC is calibrated using standard solution. By comparing the data obtained from sample to that obtained from the known standard, sample ions can be identified and quantitated. The data collection system (PC software), produces chromatogram (a plot of the detector output vs. time). The chromatography software converts each peak in the chromatogram to a sample concentration and produces a printout of the results (Figure 3.14b).

- “AquaChem” and “Grapher” softwares useful for groundwater data elaboration and visualization.
- ArcGIS tutorial (4-5 July 2017, IRPI staff Bari). We got familiar on how ArcGiS works using vector data and raster maps. This program is a powerful tool with a wide spectrum of application possibilities.
- QGIS tutorial lessons (IRPI staff Bari) were carried out during the last month of Diplomazia2 (from 10th July).

Experience in Italy: Social value of Diplomazia2

My experience in Italy was great. Our host institution staff of IRPI Bari demonstrated a remarkable hospitality; I would like to thank each of them. I had a fruitful time with colleagues of Course 1 and Course2 located in Bari, by sharing our different backgrounds and by building professional bridges for future collaborations. We discovered together also the beauties of Apulia region, all of which will be unforgettable memories.

How diplomazia2 can improve my future perspectives

Networking with CNR scientists across Italy who work on multi-disciplinary research areas, and knowing Diplomazia2 participants, will all have a positive effect on future collaborations. Diplomazia2 can be a good opportunity to work together in the future for: bilateral project proposals, organizing workshops and conferences, exchanging students between institutes, or building institutional collaboration between countries. Thank you to all the people involved in organizing Diplomazia2.

Diplomazia2 program helps to strengthen intellectual and cultural bridges between countries that share the same unique resource, the Mediterranean Sea.

MOHAMED HASSAAN

Egypt



BIOSKETCH

- B.Sc. in Marine Science, Faculty of Science, Al-Azhar University, Cairo, Egypt (2005).
- M.Sc. in Chemical Oceanography, Faculty of Science, Alexandria University, Alexandria, Egypt (2010).
- Diploma in Biochemistry, Faculty of Science, Suez Canal University, Ismailia, Egypt, (2010).
- Ph.D. in chemical Oceanography and Marine Pollution, Faculty of Science, Port Said University, Port Said, Egypt (2016).
- Researcher in The National Institute of Oceanography and Fisheries (NIOF), Egypt, Since 2013.
- Areas of interest: Chemical Oceanography, Marine Pollution, Water and Wastewater Treatment.
- Hobbies and Sports: in my free time I love to play table tennis, football, chess and ocean cruises.

Why I have applied for Diplomazia2 and expectations

Actually, this is not my first time to apply for Diplomazia program and it was a great pleasure for me to be among the selected applicants for Diplomazia1. My past experience with Diplomazia1 pushed me forward to apply for Diplomazia2 and really it was unbelievable to be among the selected applicants again. The reasons to apply for both Programs are to learn and gain a new expertise, as well as to work with highly qualified professors and researchers. Also, another very important reason for me to be involved into Diplomazia2, is to establish a future cooperation between NIOF (my institute) and CNR institutes if possible, as I made my Diplomazia1 experience.

My experience as Diplomazia2 Fellow

The activities could be divided into 3 parts according to what I have done:

The 1st part is the theoretical courses which lasted 45 days. This part was very interesting, since, at least more than 80 % of the courses were completely new and far from my area of expertise. During this part we had intensive lessons that covered the following topics: Climate and models, Mediterranean Weather and Atmospheric Environment, Geographic Information Systems (GIS), Landslide susceptibility, hazard and risk, models and maps, Coastal aquifer: from theory to practice, Theory of hydro-morphology, Soil physical and

mechanical characterization and finally SAR interferometry and hydrological processes. From my point of view, the most important benefit of these courses was to give me a chance to define the field where to develop my work (satellite data analysis) in the following period of the Diplomazia2 program, between May and June.

The 2nd part was the practical part (laboratory work), which took place at IRPI-Bari and lasted 40 days. This included working with different water samples (marine, fresh and ground water) in order to explore the phenomenon of sea water intrusion in the coastal aquifers. During this part, we measured Cations and Anions by using IC (Ion Chromatography) obtaining some calculated results to compare with the measured ones. Other water analysis tests were done such as; Alkalinity, pH, TSS, etc.

The 3rd part was carried out both at ISAC-Rome (15th MAY to 15th June) and IRPI-Bari (15th June till the end of the course). During this part I had a new experience with satellite data analysis (e.g., chlorophyll and TSM maps, climatology, and trends) also working with Linux system and MATLAB program. The main aim of this work is to monitor chlorophyll (Chl) concentrations, which is a proxy of phytoplankton biomass, and eventually consider them as an efficient tool for recording and understanding the response of the marine ecosystem to human pressures and thus for detecting eutrophication.

We wanted to compute Chl trends over three Italian seas (The Tyrrhenian Sea, The Adriatic Sea and The Ionian Sea) by using satellite data, also highlighting the fact that remote sensing may represent an efficient and reliable solution to synoptically control the “good environmental status”. However, due to the large amount of Data (Hundreds Gigabytes) I worked only with data analysis of The Adriatic Sea between 2002 and 2012 years, along with one of my colleagues in ISAC (Iacopo Vona). Also, it was a great chance to meet ISAC researchers who have already established a cooperation with NIOF and this is a good step for future projects that I may be involved into.

Finally, I participated in the training days on “European institutions and European research programs and strategies” held on 6th – 7th June 2017 at CNR Headquarters in Rome-Italy.

Experience in Diplomazia2

Really, it was a great pleasure to be here again. Everything was perfect for me, although at the beginning I felt to be in the wrong place because the topics were far from my area of interest, but later I realized that this was the opportunity

to learn new topics and to link these topics with my studies. Actually, this is what I tried to do and what I have done during my visit to ISAC.

It is worth mentioning that my coordinators (Piernicola Lollino in IRPI- Bari and Federico Fierli in ISAC-Rome) were very helpful and also standing beside me and my colleagues. They arranged my visit to ISAC in Rome with Federico Falcini, the one I have to thank for his kind treatment and for giving me a chance to learn and benefit, as much as I can, from Diplomazia2 Training Program. Also, I made many friends both at ISAC and IRPI and it was an honor for me to meet them all.

Experience in Italy

Well, Italy looks like Egypt, almost the same as Mediterranean people are always smiling and very friendly. Moreover, I like coastal cities because I live in Alexandria, one of the best coastal cities in the world. So, it was very easy for me to live in Bari where you can find beaches and fishes.

How diplomazia2 can improve my future perspectives

Actually, Diplomazia2 was a very useful program for me because it gave me the chance to learn interesting topics such as satellite data analysis which could hopefully be part of my future studies. Also, I hope to establish future cooperation projects between NIOF and CNR institutes to be added to those already established.



BIOSKETCH

Yassmin is an assistant researcher in Central Laboratory for Agricultural Climate (CLAC) - Agricultural Research Center (ARC) – Egypt. In 2009, she granted B.SC in math and computer science from Faculty of Science – Cairo University, in 2011 Yassmin obtained Diploma in Meteorology, then M.sc degree in Meteorology in 2014, and in 2017 submitted her Ph.D. thesis entitled “Climate change outlook and its impact on drought in North Africa”. For the last 7 years or so she has been focusing her research on understanding climate variability in Egypt and in the impact on agriculture sector, also using satellite data in studying specific climatic phenomena like drought, flood, etc. She participate in several national and international workshops, training courses, and conferences in this field and worked, as a member, in the national project of “Regional climate change database for agriculture sector in Egypt”.

Her favorite hobby is cooking, also she likes to listen to classical music.

Why I have applied for Diplomazia2 and expectations

When I read the Diplomazia2 Call and found my research area included in it, I searched about the course institutes and found that they are very relevant for my work. I was pretty sure that getting this opportunity, would grow my experience and would represent a new stage in my scientific path in terms of learning and collaborations. In addition, some colleagues from my country who were accepted for Diplomazia1 gave me a positive feedback on the program, so I was motivated to apply for this fellowship.

My experience as Diplomazia2 Fellow

Activities report

My host Institute was ISAC and from the first day the scientific coordinator (Dr. Federico Fierli) started to show us the Institute activities and introduce us to ISAC staff. This step helped me a lot in determining in what the Institute will be useful to my research work and, after one week, the plan of our work there became clear to me.

We decided with Dr. Chiara Cagnazzo (my project tutor) to work on studying the climate change and impact on agriculture, focusing on the Mediterranean region. The Mediterranean region is considered a climate change hotspot, and studying the impact on agriculture and the response to this change, is a big challenge because this region has a large variability in its climate and resources. The northern Mediterranean countries are characterized by a relatively cold climate with humid conditions while its southern countries are characterized by hot climate and dry conditions. The project title is “Climate projection uncertainties and implication for climate extremes and agricultural indices”.

During the 6 months of the fellowship, we obtained the global climate data of 33 climate models of Coupled Model Inter-comparison Project (CMIP5) and evaluated them with the observations of the daily precipitation, minimum temperature, maximum temperature, and average temperature of the period 1979-2005 on the Mediterranean region. Also, we studied the extreme heat and cold waves, as well as the extreme wet and dry events for the historical period, then we started to calculate a different set of agricultural indices, like evapotranspiration, frost days, growing degree days (GDD) for thermal and cereal crops, which gave us important metric and information about agricultural crops helping to determine the suitable adaptation methods that are required due to climate conditions. The first steps have been done on the absolute data of climate models and also after correcting it with observations; this step showed us how much the correction makes sense in the results especially in studying the indices either climatic or agricultural.

After studying the historical climate, climate extremes, and agricultural indices, we started to work on the future scenario data. In this part, we used the moderate scenario ‘Representative Concentration Pathways (RCP) 4.5’ of 29 global climate models and applied the same methodology used in the historical data. The results’ analysis shows valuable conclusions for the Mediterranean region and we are going to publish them on one or two scientific papers with our project tutor (Dr. Chiara Cagnazzo)

The previous work has been done in parallel with the online theoretical course which continued for six weeks focusing on several interesting topics in the field of research giving background on the other related scientific topics, also it contained some practical sections on the use of new tools in the research.

My experience during Diplomazia2

ISAC was one of institutes that I wished to visit the most in my scientific life. Actually, to be with such staff for six months gave me the chance to have valuable discussions with professional professors, for example,

The project tutor helped me not only in the project topic but also in understanding and interpreting a lot of complicated scientific points that are not easy to learn by myself, and the discussions with her after the practical work changed my vision on a lot of results and how to analyze and explain them. Also, she gave me valuable advices which had a major role in improving my Ph.D. thesis that I will submit in the next few weeks from now.

Discussions with one of the course tutors (Dr. Silvio Davolio) on how to use high-resolution weather forecast models (BOLAM and MOLOCH) which have been developed at ISAC, and he accepted to give me two days training in Bologna under his supervision. Also, we agreed to sign an agreement between ISAC and meteorology department of the faculty of science in Cairo University to use these models in Egypt. The use of very high-resolution weather forecast model and use its output in calculating the agricultural application to reduce the risk on agricultural sector due to expected weather conditions, is an activity that will be done in Egypt for the first time.

Discussions with another tutor (Dr. Giulia Panegrossi) when seeing one of my last activity in using Satellite data in the agricultural application and she gives me worthy comments which improved this work and we agree to collaborate in a scientific paper(s) together in the future. The first one is ready to be published now and will be submitted shortly in one of the international journals.

Also during the program period I have been accepted to participate in the “Fourth Workshop on Water Resources in Developing Countries: Hydroclimate Modeling and Analysis Tools” in the International Centre for Theoretical Physics (ICTP), Trieste- Italy during the period (12-23 June). From this workshop, I learned to install and run the Cetemps Hydrological Model (CHyM) which can be coupled with the weather and climate models to use mainly in flood alert mapping and hydrological risk management and give a detailed analysis for the hydrological situation.



Figure 3.15: workshop International Centre for Theoretical Physics

In addition, I had contact with one of the professors of Institute of Biometeorology (IBImet), Dr. Marina Baldi, after I found I can collaborate in many activities with this institute which focuses its research on the meteorology and agriculture. She was very supportive and cooperative, and we

discussed to prepare a memorandum of understanding (MoU) between (ISAC, IBImet, and CLAC) with the aim to collaborate in Joint Research and Development projects and initiatives, seminars, workshops, and training activities on scientific and technical subjects of common interests, exchange of researchers, professors, students and their all affiliated staff of each Party, and exchange of scientific documentation. Now the MoU is under revision from all partners.

Participation in Diplomiza2 was an experience which added a lot to me, not only at a scientific level by learning to run new models, improving the method of research and using new fast and sophisticated tools, but also at a personal level by taking confidence in presenting my work and explaining my point of view to others, and by expanding the researchers network who can collaborate with me in the future.

My experience in Italy

One of most useful points that I gained from this visit is that I learned to understand Italian language a bit and also to speak it a little. Furtherly, I have gotten to know closely Italian history and culture. It was a good chance to know more about the traditions of Italian people especially concerning festivals and events.

How Diplomazia2 can improve my future perspectives

Participating in Diplomazia2 has represented a big milestone in my career development. I will strive to use the gained skills and knowledge in the best possible way, and I will continue to work on their improvement in order to reach the desired career objectives, and will work on continuing to cooperate with many professors. Also, I expect that the course will have a role in enhancing good opportunities for me in the future.

Acknowledgement

I would like to deeply thank all who are responsible for the Diplomazia2 program and all ISAC scientific staff as well as the administrative and technical staff. I would like to express my special thanks to the scientific coordinator of



Figure 3.16: Trips in Italy

our course Dr. Federico Fierli who permanently supported any idea that can benefit us and continued to encourage us to achieving the maximum from the activities within the limited time frame; to Dr. Chaira Cagnazzo who always provided me with a valuable scientific guidance, to Dr. Giulia Panegrossi and Dr. Silvio Davolio who gave their time and experience to me, and to Dr. Francesco Cairo (Responsible of ISAC - UOS Roma) for welcoming us all the time and doing his best to solve any problem we had to face. Also, I would like to express my gratitude to Dr. Marina Baldi from IBImet for her supportive and continuous effort to produce fruitful cooperation.

I am really thankful to all of them.

ADANELA MUSARAJ

Albania



BIOSKETCH

Born in Albania, I studied Natural Science. Doctor in Biology in 2008. I boost my professional experience with social and volunteer activities that helped me to better understand the community needs and the legislation and policies effect on everyday activities of SME. Following financial, leadership, and IT project management training, and also strategic communication, IT management on public sector, Public Policy analyses and EU policy on Western Balkan countries I helped myself to better understand and develop my leadership skills and implement them in my job in the cabinet of the Minister, part of Public Administration. Exploiting my agility on foreign languages, I followed an impressive number of informative activities on European Financial instruments on research and development, as well as meeting with professional organisations, acting as lobby on IT, climate, environmental and trade market. Have been Project coordinator on different project with large budget, financed by European Union, USAID, Asian Bank for Development, etc.

I play tennis a lot and love to swim in long distances.

My experience as Diplomazia2 Fellow

activities report

During this training and intern experience, three main activities has been followed:

- An intense calendar of trainings and events regarding European Financial tools for Research and Development.
- An assessment report on geothermal plants impact on Biodiversity and environmental , with the support of Dr.**Adele Manzella**, Geothermal energy Dep.
- Performance analyses for education and training in geothermal market. The aim of this report was evaluation of the possibility on reopening the International School of Geothermal Energy of Pisa , with the support of Dr.**Adele Manzella**, Geothermal energy Dep.

Outputs and Deliverables

A monthly progress report for the Director of IGG:

- An assessment report on geothermal plants impact on biodiversity, wildlife and environment, delivered to the intern Leader, Dr. A. Manzella (Geothermal researcher, and Project leader on Geothermal Energy, at IGG, Pisa) and to the Director of IGG.
- A performance analyze report, a financial report and a SWOT analyze for the education and training on TVET geothermal working market preparation, to Dr. A.Manzella and to the Director of IGG, Pisa.

Biodiversity and environmental assessment on geothermal plants

Ecological decision-making should be directed to the preservation of biodiversity (including flora and soil and its component macro- and micro-fauna), ecosystem functionality and resilience to ensure the provision of ecosystem services, a strategic plan for the management of geothermal sites in the first instance requires the development of decision tools to direct ecological decision making (1). To this end, during the intern period, comparative analyse of literature has been done, in terms of UE financed projects, reports and scientific publications.

We evaluate:

- the gaps and tools for environmental assessment
- the biodiversity management in these geothermal sites
- the effect of power plant on tourism and recreation, in different countries, as well as the social engagement and acceptance
- best practice

Environmental impact of geothermal facilities ¹ has been studied and classified in different categories, while listing the main activities of these industrial plants (2).

• ¹ Surface disturbances, such as those caused during the plant construction possibly affecting flora, fauna, surface water (access roads, pipe and power lines, plant and associated land use).

To identify the gaps and the tools for further environmental evaluation, we employ the habitat value, the environmental facilities, threats and economic opportunities in geothermal plants.

To evaluate the biodiversity management in these geothermal sites three parameters specific to geothermal features have been identified (3):

1. Pollination: the objective to clarify the role of both native pollinators (timing and abundance) and the honeybee (potential for disruption to native pollinator) (4) (5).
2. Invertebrate fauna: the objective to record the abundance and distribution of the native scarabs (*Pyronota* sp. and *Eucolaspis brunnea* (Fabricius) at sites with differing adjacent land use to determine the relationship (3) (6).
3. Ectomycorrhizal fungi: the initial objective would be to record abundance and distribution with respect to site characteristics. A fundamental question would be as to whether these fungi are confined to raise root mats of prostrate kanuka. The specifics of the role of the fungi would be the role of an academic study (7).

Many aspects of geothermal systems are yet to be understood; for example, the influence of pollination and the role of pollinators with respect to the sustainability of unique geothermal plants. Currently there is not enough information to identify confidently species requirements requirement for pollination services. What we can infer is that there may be competition for the pollen/nectar resource by both indigenous and exotic fauna including birds and insects.

While pollination/pollinators is but one example, it does serve the purpose of illustrating at this early stage in the development of evaluation tools the components require field testing to verify that the aspects chosen to populate the tool are those most suitable in terms of practicality and robustness.

-
- Physical effects, like the effect of fluid withdrawal on natural manifestations, land subsidence, induced seismicity, visual effects (buildings, cooling towers, surface pipelines, power transmission lines etc.)
 - Noise, such as equipment noise during drilling, construction and operation.
 - Thermal pollution, such as due to hot liquid and steam release on the surface.
 - Chemical pollution, like due to disposal of liquid and solid waste, gaseous emission to the atmosphere, natural radioactivity etc.
 - Protection, such as ecological protection (fauna and flora).

In addition, the effect of power plants on tourism and recreation on different countries has to be further evaluate as well as social engagement and acceptance for geothermal plants.

The case of Italy, where the population erroneously link earthquakes activities the geothermal activity, is a good example of strong society impact on industrial development and biodiversity preservation (8). Also the Island case, when tourism is a very important economic parameter for the GDP of the country, is an excellent standard to follow for other developing countries, like Kenya, with lately huge investments on geothermal power (3).

Performance analyse for education and training in geothermal market Analyses and education assessment approach for capacity building strategies

The aim of this research was a valuation of further development of Vocational Education Training for the geothermal market, making assessments and evaluation of the geothermal Labour market situation, investments and occupations in geothermal energy in 2017, Economic situation of Italy and assessment of Italian geothermal market on 2017, Analyses and education assessment approach for capacity building strategies, Science occupation is an important component of geothermal development, because drilling wells is extremely expensive, concluding this analyse with Vocational Education Training in geothermal capacity building, referring to the capacities of IGG, Pisa to reopen the International Geothermal School of Pisa.

Although an online survey on “Youth employment and unemployment in the geothermal sector for 2017” should be made, a backward planning on instructional education for geothermal market, has a crucial importance.

Other authors, have made further market research, regarding the performance analyses needs, referring that the major problem of the geothermal industry employee, are the missing skills, the inappropriate education and the insufficient professional experience (9). It is one thing to determine the needs of the performers, such as skills, knowledge, and their self-system (attitude, metacognition), but it is quite another thing to ensure that those requirements actually take place. An excellent tool to evaluate this process is the circular causality (10)

Therefore, the Training Needs Analysis (TNA) is necessary to see if a learning or training solution will solve a business problem, as in the case of geothermal market work (11). To better, understand the training needs and the educational market offer, different projects has been supported by the European Union, as Geothermal ERA NET (12), GEO ELEC (13), Geothermal Energy (14), or

Geothermal Education and training in Italy (15). These projects evaluate the geothermal degrees and research and development programmes offered by the Universities all over Europe and beyond.

Due to high expenses on programmes offered by the universities, despite the quality of the curricula or the performance evaluation of the University that offers the programme, a convenient approach has been used for geothermal capacity building : the “Create Adapt Acquire” approach. The “Create Adapt Acquire” approach (16) recognises that the types of geothermal expertise required are available globally – with both individuals and companies freely moving their expertise around the world – and that countries or companies might decide (initially) to not create all needed expertise locally, but to rely in part on external expertise . It also recognises that, because specialised, geothermal expertise overlaps with other industries (especially petroleum, heavy engineering and mining) and can be used from those sectors, this expertise can be adapted to fit the geothermal sector.

The situation in the last 20 years has changed, in education interests, in technological skills needed, abilities, tools used, tasks and knowledge that reflects not only the IoT , but also the market needs for poly competencies workers with low financial investments in education, in terms of money and time.

A good solution for long-term development policy in geothermal market training and education, following cost efficiency balance, may be Vocational Education Training programme, offered with the support of the Industry, Government and European Agencies.

The content of **VET (Vocational Education Training)** (17) programmes is largely defined by the curricula for particular courses and job profiles. For the integration of renewable energy into the VET system, there could be opportunities for both, upgrading existing curricula by integrating modules in existing curricula and professions covering renewables, or developing new curricula.

The focus of training within the VET systems is mostly on practical (technical) skills and competences, in entrepreneurial skills, including economic or management skills as well as project development skills. However, in many cases the lack of proper teaching equipment impacts substantially on the quality technical skills acquisition of students. Similarly, the quality is jeopardised by the lack of practical experience of teachers, the generally rather

low payment levels (and resulting motivational issues), and a general lack of training for trainers/teachers.

Course material, as well as pedagogical tools, equipment, and demonstration material are central to teaching those curricula. For renewables in particular, the practical dimension is considerable. Companies (including European) are often instrumental in the development of demonstration material or projects.

Distance and blended learning is starting, UNESCO for example is experimenting with mobile training units (comprising trucks, tents, trainers, materials, etc.) to provide short courses in disadvantaged areas. Training integrated into companies (e.g. in the form of internships or integrated apprenticeships) are rarely an integral part of VET systems. In some countries, apprenticeships are a tradition, yet take mostly place informally and outside VET systems. In particular, in the informal economic sector, young people are often taken on as apprentices. While they acquire practical skills through their on-the-job-training, they do rarely receive any theoretical education.

Bibliography

1. **GNS.** *Some like it Hot, life in New Zealand geothermal Environments.* s.l. : GNS, 2015. ISBN 978-0-478-19910-9.
2. **Adele Manzella, Robero Bonciani, Assunta Bottegi, et al.** *Environmental and social aspects of geothermal energy in Italy.* s.l. : EUROPEAN UNION, 2013.
3. **Council, WAIKATO Regional.** *GEORGA Manaing biodiversity in geothermal sites.* 2014.
4. **Kelly D, Hart DE, Allen RB.** Evaluating the wind pollination benefits of mast seeding. *Ecology.* 82, 2014, Vol. 1, 117-12.
5. **Merrett MF, Robertson AW, Peterson PG.** Pollination performance and vulnerability to pollination breakdown of sixteen native shrub species from New Zealand. *New Zealand Journal of Botany* . 45, 2007, Vol. 4, 579 -591.
6. **Industries, Victoria Department of Environment and Primary.** *Vegetation Quality Assessment Manual – Guidelines for Applying the Habitat Hectares Scoring Method.* 2004.
7. **Willoughby B and Beard C.** *Invertebrate macro-fauna in geothermal soil under native vegetation in the Waikato Region.* s.l. : Waikato Regional Council Technical Report, 2013.
8. **A.MANZELLA, et al.** *Environmental and social aspect of geothermal energy on Italy.* s.l. : CNR, 2017. DRAFT.
9. **Nathalie Richet, Eva María Llera Sastresa, Jarry Scheepens-Hasek, Gerrit Kuiken, Hanze.** *KnowRES- Deliverable 3.1 - Skill gaps analysis report* . s.l. : EUREC, 2016.

10. **Gelade, Garry A., and Mark Ivery.** The impact of human resource management and work climate on organizational performance. *Personnel psychology*. 56, 2003, Vol. 2, 383-404.
11. **Tovey, Michael D.** *Training in Australia: Design, delivery, evaluation, management*. s.l. : Prentice Hall Australia, 1997.
12. **NET, GEOTHERMAL ERA.** *GEOTHERMAL ERA NET*. s.l. : Geothermal ERA NET, 2015.
13. **GEOELEC.** *How to finance a Geothermal power plant in Europe*. s.l. : CORDIS, 2013.
14. **Eva Schill, Ruggero Bertani, Adele Manzella, et al.** *IMAGE (Integrated Methods for Advanced Geothermal Exploration)*. s.l. : OPEN Air, 2015.
15. **Adele Manzella, Federica Caiozzi, Eugenio Trumphy.** *Geothermal Education and Training in Italy*. PISA : Consiglio Nazionale delle Ricerche, 2013.
16. *Innovation creation and commercialization beyond the firm: A multi-level framework.* **Bogers, Marcel, and Joel West.** s.l. : DRUID Conference, 2014.
17. **Commision, European.** European commision Education and training. *ec.europa.eu*. [Online] https://ec.europa.eu/education/policy/vocational-policy/ecvet_en.
18. **UK Department of Trade and Renewables.** *Renewable Energy Industry Gap Analysis: Summary Report*. London : Department of Trade and Industry, Crown cp, 2007.
19. **Bertani, Ruggero.** *Geothermal Power Generation in the World* . s.l. : IGA, 2014.

How diplomazia2 can improve my future perspectives

The global extension of economical interest on geothermal and georesource of Italy with new information on how and about of financial instruments on research and development, boost my prospective on new collaboration and updated my background on further scientific and economic insight , that will serve me to a winning project propose on Marie Curie Individual Fellowship 2018

The science has no homeland, but this professional course helped me to a better understanding the science dynamics, viewed by a G8 country Center of Research.



BIOSKETCH

I graduated in 2010 with an engineer's degree in Hydrometeorology from the National Engineering School of Tunis.

Since February 2013, I am working in the research department at the National Institute of Meteorology of Tunisia. My research focuses on understanding the observed climate variability and change over Tunisia and on the evaluation of climate models and development of climate information products to be used in adaptation. I am interested in using a variety of tools and datasets, including global climate models, regional climate models and observed and remote-sensing data sets, in order to provide downscaled climate datasets required for many impact studies in Tunisia. I have participated in many international and regional forums related to climate change issues.

I like helping people who want to improve their lives. I like doing this because there is nothing more rewarding than seeing people happy.

My favorite hobby is football. Since childhood, I loved to play soccer and watch football matches. Now I play football with my colleagues after work and on weekends.

Why I have applied for Diplomazia2 and expectations

I have applied for Diplomazia2 because the first edition of this training (Diplomazia1) has a good reputation, according to the feedback of some participants from Tunisia. They emphasized that the course was very useful because it combines practical and theoretical learning. It gave them an opportunity to acquire new knowledge in several domains as well as making practical work related to their fields of interest. It was also an occasion to meet many young graduates from different countries and cultures and build a network of contacts for the future.

When submitting the application, I focused on course 1 of Diplomazia2 program «Environment/climate change/resilience with particular attention to the Mediterranean area», as I thought that course 1 could fit in perfectly with my expertise and my career aims. It involves the climate change issues in the Mediterranean area that well matches my research domain.

Before the beginning of my training, my expectations were high, because, having already followed several internships abroad for short periods in many countries, I knew what to expect from an internship in general. But Diplomazia2 was my first training for a longer time. I wanted to practice and to improve the different skills I developed during my education and my work such as: enhancing my capacity to understand climate change better and explaining several frameworks, tools and techniques to facilitate planning and designing adaptation actions.

My experience as Diplomazia2 Fellow

My experience during Diplomazia2 and my activities report

I officially started my internship on January 30th, 2017 at ISAC in Rome. During my first days at ISAC I got a general view about the several research groups and activities of the institute, many meetings were held with the staff of ISAC for that.

Then the program of my stage was defined by our coordinator and it involved two main activities: the first is related to theoretical courses given by researchers from ISAC, IGG and IRPI. My second activity was to make a research project related to my field.

Theoretical courses

The theoretical courses have had 7 weeks duration and have provided essential information based on the research field of each institute. Lectures were focused mainly on the following topics:

- The first part of the lectures given by the researchers from ISAC covered all main aspects of the climate system with introduction on the role of atmospheric and ocean circulation, energy balance and surface exchange, carbon cycle as well as the concept of climate forcing. The second part provided a basic understanding of satellite and Remote Sensing technology.
- The speakers from IGG have explained two main topics: Geodynamics (geological processes, chemical and geochemical approaches, Geochemical modeling...) and underground water resources (geothermal energy, aquifers, hydrogeology, isotope hydrology, hydrological cycle, Climate effects on water resources)
- The last part of courses was given by the researchers from IRPI and was focused on natural hazards including floods, landslides, ground subsidence and depletion of surface water and groundwater. The lectures offered also an overview of methods, models and tools for the prediction and prevention of geo-hydrological hazards and their consequences.

The theoretical courses allowed me to greatly improve my knowledge on climate and atmospheric sciences matching my specialty and to add new knowledge and concepts

Research project

The general target of my stage is to study the climate change issues in the Mediterranean area. In this framework my research work was defined, based on my knowledge and my skills gained during my education and my work. The title of our project is «Climate projection uncertainties and implication for climate extremes and agricultural indices». The aim is to provide a coherent picture for the future changes in climate means, extremes and agricultural indices required for impact assessments of climate change in the Mediterranean region. We used the global climate models (GCMs) simulations of CMIP5 (the fifth phase of the Coupled Model Inter-comparison Project).

Our analysis was based on a daily mean, maximum and minimum temperatures and total precipitation, which play a key role in the estimation of the agricultural indices, climate extremes, and evapotranspiration. We used ERA-Interim produced by the European Centre for Medium-range Weather Forecasts (ECMWF) as the reference data set to assess model performance and to create a bias corrected data of CMIP5 models.

To get a robust estimate of future changes in the indices we utilized the multi-model ensemble approach, which involves data from different GCMs and, in order to better understand the future climate projections uncertainties, two methodologies were proposed:

Methodology 1: We analyze the ability of 33 different Global Climate Models (GCMs) from CMIP5 to simulate mean climates and indices using the absolute data over the Mediterranean region. The aim of this methodology is to choose a set of suitable GCMs to be used for future climate change in the area.

The figure below, as an example, shows the ranking of 33 models according to their ability to reproduce the Cold Night Index (viticultural climate index developed to estimate the nictothermal condition associated with the grape maturation period). The left Figure shows the projection of the mean Cold Night Index using the top 10 models.

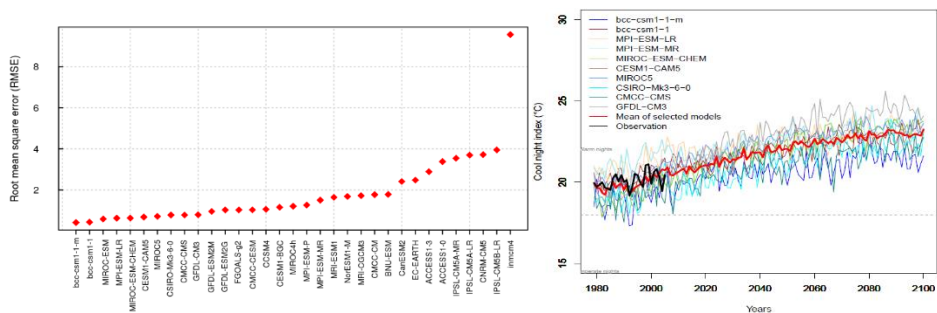


Figure 3.17: CMIP5 GCMs ranked according to root mean square error score (in the left), the future projection of the mean cold night index over the domain 18W-40°E, 18N-50°N (in the right).

Methodology 2: The goal of this methodology is to keep and use the 33 simulations. To avoid large relative errors, we create a bias corrected daily climate dataset of all models which can be used to estimate the future projections. The Bias Correction approach consists of using raw model output for the future period, and to correct it using the differences between historical reference data from the model and observations. The figure 2 summarize the similarity between the bias-corrected and the observation (ERA-interim) data of the monthly mean temperatures during 27 years period (1979–2005) for the 33 models.

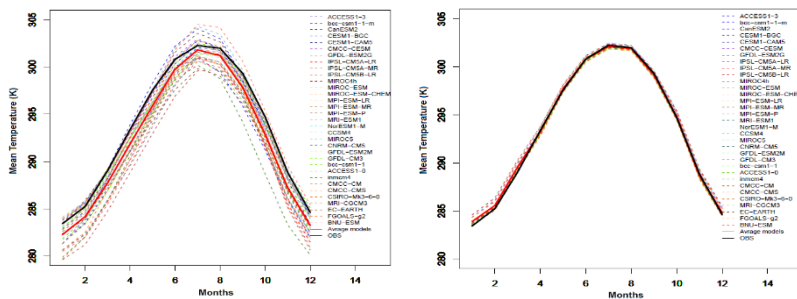


Figure 3.18: The Difference between absolute values (left) and bias-corrected data (right) of the mean monthly temperatures

The most important part I took away from Diplomazia2 course is the importance of the practical part. It was a great experience that allowed me to better understand how to manipulate, correct and evaluate climate models outputs needed for climate change impact assessments. During my stage, I had the opportunity to develop many tools used for the data processing, manipulation, graphics visualization and computations of many climate extremes and agricultural indices. These tools were validated by my tutor. That is very useful for my future work and career.



Figure 3.19: Photo taken in ISAC with My Tutor Chiara Cagnazzo on my left

My experience in Italy

Initially, at my arrival in Rome, I was worried about the new culture, new language, new accommodation and new food. But my knowledge of some Italian words made the language feel readable and it was easy to pick up short phrases. The food was overall very good and close to what is served in Tunisia. In my free time in Rome, I did several diversified things, including going to see museums, visiting all historical sites and buildings and attending numerous events.

How diplomazia2 can improve my future perspectives

Diplomazia2 has introduced me to a lot of useful resources and has given me the opportunity to meet a variety of professionals and researchers. All that can increase my chances of forging solid connections and boost my career and for future possible cooperation. My research project allowed me to become familiar with the climate model outputs and making these data more useful for the decision makers.

Climate change is a challenge in Tunisia and directly impacts two major sectors on which the Tunisian economy depends: agriculture and water resources. My Institute is the only organization specialized in climate services; we are committed to provide climate change information required for many impact studies thus, Diplomazia2 will help to generate in the future these products with more consistence and confidence.

At the end of this program I would like to thank my supervisor, Chiara Cagnazzo, a researcher in the group of “Climate dynamics and variability: processes, reconstructions, scenarios and impacts” of ISAC. I consider myself lucky to have had her as my supervisor, because she is very supportive and friendly and would always find time for my questions, also being willing to help. In addition, there is another person who played an important role during my internship – Federico Fierli, the coordinator of our course, who always

pushed us to work and to cooperate with each other. Finally, I cannot forget the fact that Francesco Cairo, The director of ISAC-Rome, together with all the course teachers and ISAC staff are very nice people and made me feel welcomed from the very first day of my internship.

3.3 Tutors and Lecturers

SAMUELE AGOSTINI

CNR – IGG, Lecturer



BIOSKETCH

Samuele Agostini is researcher at IGG-CNR and manager of TIMS-Clean Room laboratory.

Main research interests are petrology, geochemistry and isotope geochemistry of magmatism in converging systems, the relationships between magmatism and geodynamics, and the application of geochemical and isotopic methods to geo-environmental researches.

Currently, Samuele Agostini is author of 41 scientific papers and his H-index is 13 (Google Scholar database).

Abstract

Lead radiogenic isotopes and Cr stable isotopes are some of the most important isotope tracers in hydrology.

Lessons briefly summarized the basic principles of radiogenic decay and isotope fractionation, before showing some possible applications of the methods.

In more detail, Pb isotopes are part of the systems of long-life radiogenic isotopes, whose ratios do not change significantly in human times, but strongly change (or had changed) in geologic times. As a consequence, different Earth reservoirs acquired a different parent/daughter ratio and then different radiogenic isotope ratios. Then, radiogenic isotopes can be used to trace Earth reservoirs, and, namely, Pb isotopes in waters, may trace water/rocks interactions, water circulation as well as interaction with atmosphere and rainwaters. Examples shown include tracing of pollutants in rivers, in tap waters, in PM₁₀, irrigated agricultural soils, industrial soils, variations of Pb isotope in rainwaters.

Chromium isotopes, instead, vary as all of the non-radiogenic stable isotopes by equilibrium and kinetic isotope fractionation. After introducing basic principles of stable isotopes, it has been evidenced that Cr may be found in nature in two oxidation states: Cr (III), with a very limited water solubility, is an important trace nutrient for man and most mammals, Cr (VI) instead is

highly mobile in waters and is a strong toxic and carcinogen agent. Cr isotopes are useful because redox reaction of Cr cause significant isotope fractionation. In particular, most Cr isotope fractionation is linked to Cr reduction, thus Cr isotope are the best tracers of Cr reduction, both in natural environment or in anthropogenic remediation. Monitoring of Cr redox processes is very important in water rocks interaction processes given that Cr toxicity limits in water is extremely low ($5 \text{ ng} \cdot \text{g}^{-1}$ of Cr(VI)), whereas some rocks and sediments may show up to $3000 \text{ } \mu\text{g} \cdot \text{g}^{-1}$ of Cr, which is usually in trivalent state, but may be, for some reasons, oxidized. Examples of Cr isotope studies in hydrology thus were mostly targeted to examples of monitoring Cr(VI) to Cr(III) man-induced reactions in remediations processes, as well as the possible natural oxidation and back-reduction of Cr during water/rock interactions, especially in Cr-rich aquifers containing, such as ophiolitic rocks or sediment containing ophiolite-derived materials.

ILARIA BANESCHI

CNR – IGG, Teacher



BIOSKETCH

I am a researcher in environmental geochemistry at the Institute of Geosciences and Earth Resources-CNR of Pise. I am specialized in environmental geochemistry and biogeochemistry of aquatic system, sediments and soil, with a focus on human impact.

My current scientific activity investigates chemical and biochemical processes that occur in lakes and wetlands in order to interpret changes in the geochemistry of lake sediments, to identify human impact and to reconstruct environmental and climatic changes, using also the stable isotopes of carbon, nitrogen, hydrogen and oxygen as tracers. I'm also interested to understand geochemical-biogeochemical cycles and material exchange processes at interfaces between the various compartments that characterize ecological and geological systems, in particular the earth critical zone.

Abstract

In the context of “Diplomazia 2” project, the lessons covered: 1) the sampling techniques and the critical aspects for stream sediment and soils; 2) methods and applications of stable isotopes in water and precipitation.

The students during these lessons have learned basic concepts about the origin and the geological and environmental evolution of stream sediments and soils. The lessons cover fundamentals of stream health then introduce to basic information about scientific sampling through examples. These lessons will not only cover core geology, chemistry, and environmental science concepts, but will help prepare students for outdoor hands-on projects like trips to a stream or a field for sampling stream-sediment or soils for study pollution.

Moreover, the students were introduced to the use of stable isotope geochemistry in environmental geochemistry. In particular, the lessons included an introduction about the basics of stable isotope geochemistry, an explanation how hydrogen and oxygen isotopic shifts can be used to study hydrological cycle and what are the key-equations and processes that explain isotopic variation of rainwater, water vapour and seawater. Description of carbon and oxygen stable isotopes variations in relation to temperature and other parameters have been treated with examples of paleoclimatic reconstruction. The students have learned also the basics of mass-spectrometer functioning for isotopes analysis and data elaboration. Examples of application of stable isotopes geochemistry of hydrological studies, isotopes thermometry, Sulfur isotopes and microbes, and forensic application have been discussed and presented to the students.

CHIARA BOSCHI

CNR – IGG, Teacher



BIOSKETCH

I received my Master in Geology at Dept. of Earth Sciences, Pisa University (Italy) in 2001, and the Ph.D. in 2006 at the Swiss Federal Institute of Technology, (ETH-Zurich, Switzerland). I'm currently Researcher at the Institute of Geosciences and Earth Resources (IGG-CNR, Pisa, Italy), and Responsible of the IGG Stable Isotopes Laboratory (<http://www.igg.cnr.it/en/laboratories/laboratories/stable-isotopes-laboratory/>). My main scientific interests are the water-rock interaction processes in the hydrothermal and metamorphic environments, the

	carbonation of serpentinites related to the CO ₂ mineral sequestration and the serpentinization process. I enrich my work-life reading, traveling and sharing tasty red wine bottles with friends and colleagues.
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Abstract

My two lessons for the DIPLOMAZIA 2 project have been focus on: 1) a general introduction about the climate change and 2) the Carbon Capture and Storage.

The first lesson introduced the climate change as a political and economic problem, together with a short introduction to the Global Risk Report 2017 (<https://www.weforum.org/reports/the-global-risks-report-2017>). The recent US withdrawal from the Paris climate agreement put the climate change and the climate actions in a serious dangerous situation. Details of Kyoto protocol and of the Paris climate agreement have been added. The second part of the lesson focused on the main scientific aspects and on the numerous evidences of the climate change.

The second lesson started with the carbon cycle (long vs short-term) and the importance of the rock weathering in the long-term carbon cycle. I explained in details the weathering of the rocks, in particular the low-temperature weathering of the mafic and ultramafic rocks. The alteration of mafic/ultramafic rocks to form carbonates mimics the induced Carbon Capture and Storage (CCS). The CCS is a climate change mitigation technology, transforming carbon dioxide into solid, inert and environmentally benign carbonate minerals. I reported several examples of the on-going studies of the mineral CCS in Tuscany (Italy).

MARCO DOVERI

CNR – IGG, Lecturer



BIOSKETCH

Marco Doveri received a degree in Geological Science in 2000 and achieved his PhD in Earth Sciences in 2004 at the University of Pisa (Italy).

Since 2008 he works as researcher at the Institute of Geoscience and Earth Resources of Pisa. Most his research activities are dedicated to hydrogeological and hydro-geochemical studies, which are chiefly carried out on groundwater systems, also faced in respect to global changes. These activities concern both

	environmental and geothermal studies. He promotes and coordinates multidisciplinary studies, in which geological, geophysical, hydrogeological, geochemical and isotopic tools are involved.
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Abstract

The lessons were divided into two main topics: the first dealt with the aquifer system and groundwater flow (2 hours), the second one regarded the protection of groundwater sources used for drinking water supply (1 hour).

In the first part the different type of aquifer, the Darcy's Law, physical properties and hydrodynamic aspects of aquifers were treated. Specific test and field activities (pumping test, slug test, piezometric surveys) to achieve the value of hydraulic and hydrodynamic parameters were also described with some examples. Subsequently, the water isotopes ($^{18}\text{O}/^{16}\text{O}$, $^2\text{H}/^1\text{H}$ and ^3H) for groundwater understanding were introduced and the main properties of these ratios, very useful in hydrogeology, were described and explained. To better understand the potentialities of the isotopic tool in groundwater, the case of karst Aquifer of the Apuan Alps were reported, within which the classic hydrogeology would not have been enough to define the hydrogeological conceptual model of the aquifer system. These applications have a practical feedback in terms of management of the territory and mitigation of the risk of water pollution.

The second part was focused on the concept that groundwater, and in particular, groundwater sources used for drinking water supply, must be protected by reliable actions of management, in order to assure the safe water availability for the future generations. The lesson concerns an overview on directives and scientific-technical approaches. In particular, the different approaches adopted by each country to delineate the protection zones surrounding the sources of drinking water, in which several activities are forbidden or restricted, were treated. An example of application of the hydrogeological approach to define the protection zone of an important well field of Tuscany Region (Italy) were also shown. The integrated approach, used in the case study, involves geochemical, hydrodynamic, structural and meteorological data and their elaboration.



BIOSKETCH

Geochemist, with a background in isotope hydrology, fluid geochemistry and gas-water-rock interactions, I use numerical models to investigate geochemical reactivity in natural and anthropogenically disturbed systems.

I have interest in sports, with preference for football, fencing, basket, tennis, and table tennis, and a real passion for travels. I also enjoy listening to music (almost any kind of), reading books (fiction and non-fiction), and watching nature documentaries and dramatic films.

Abstract

Course title: “Geochemical speciation and modeling of water-rock interactions: principles and examples”

This course is designed to introduce major concepts of aqueous geochemistry and geochemical modeling. The lecture covers the main characteristics and geochemical processes involving aquifers and surficial waters, together with a fundamental treatment of equilibria in aquatic systems. Among the topics covered: chemical equilibria of solutions, including speciation, solubility, sorption and ion exchange, redox; kinetics of reactions; introduction to natural water-rock reactions, reaction progress indicators, the chemistry of groundwater contaminants; fundamentals of performing speciation, reaction-path, and reactive transport calculations.

Case studies which provide real-world application of the theory covered in the lecture are presented. The focus is on the propagation of contaminant in aquifers, and the chemical degradation of geological formations and man-made materials associated with the geological storage of greenhouse gases.

The basics of geochemical and reactive transport models are discussed and compared. The performance and the benefit-cost ratio of zero-dimensional models (geochemical modelling) and of computer models integrating chemical reaction with transport of fluids through geological media (reactive transport modeling in porous media) are critically evaluated.

This course is addressed to hydrogeologists and environmental scientists, as well as to petroleum and/or geothermal geologists.

MARIASILVIA GIAMBERINI

CNR – IGG, Lecturer and Tutor



BIOSKETCH

Mariasilvia Giamberini holds an M.S. in Chemistry and an M.S. in Environmental Management and she has more than 15 years of professional experience as consultant in environmental engineering companies. She joined IGG-CNR in 2011, and since then her scientific interest focused on the use of geochemistry, statistical analysis and isotope chemistry for the analysis of contamination of groundwater and air particulate. From 2015 she is a member of the Project Management and Coordination team of the EU H2020 project ECO-POTENTIAL, where she takes part to the research activities on the monitoring of biogeochemical fluxes of carbon in Gran Paradiso National Park. She is the Co-Coordinator of the Working group “water resources” of the Foresight project of the Italian National Council of Research, aimed to identify and suggest the future CNR research strategies.

Abstract

Mariasilvia has been lecturer for the whole group and tutor of a student, Edlira Taco. Her lectures have been the first ones of the series of lectures by IGG-CNR, and served as an introduction to environmental monitoring techniques of water. They have been focussed on the monitoring and analysis of both surface and underground water, with an insight on sampling techniques and data representation. The three-hours lecture have been organised in the format of a case-study regarding the monitoring of water in the surrounding of a sanitary landfill in Italy, starting from the understanding of the water contamination process, through the planning and the implementation of the monitoring campaign to the final reporting of results. The “case study” format has been chosen in order to let the student learn how to face a practical case and enhance their problem-solving capabilities.

In particular, the lectures focussed on the following subjects:

- Sampling planning and strategies
- In situ measures and analysis
- Main laboratory analytical techniques
- Data representation.

Sampling planning and strategies: the lecture explained the criteria used for choosing the sampling points, the sampling and the analytical techniques and any information needed for a proper planning, considering the best techniques as well as the resources available.

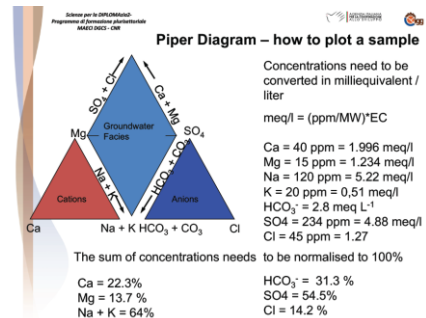
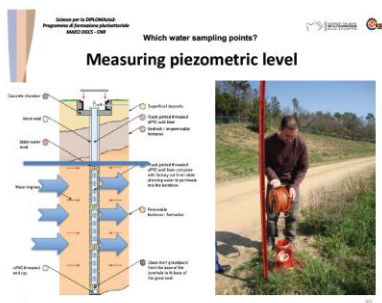
In situ measures and analysis: some parameters need to be measured in site: this lectures explained why and how to perform the best in situ measures.

Main laboratory analytical techniques: this lecture showed briefly what are the main analytical techniques for inorganic components of water and the criteria for choosing the most suitable ones.

Data representation: this lecture showed the main methods for classifying water according to their inorganic components and how to represent the different water samples using the most common charts.

The Stage of Doctor Edlira Taco was aimed to let her learn how to process a large amount of analytical data, taken from the case study used during the lecture. She has learned how to organise and group the data, and how to visualise them in charts in order to classify the water samples and infer the mixing and contamination processes. The main classification and visual representation techniques used have been: binary diagrams, Langelier-Ludwig diagrams and Piper diagrams.

The pictures below represent one technique used “in field” and one exercise for building the Piper diagram, illustrated during the lecture.



ADELE MANZELLA

CNR - IGG, Lecturer and training responsible



BIOSKETCH

Senior Scientist, she works as a geophysicist in geothermal exploration to conduct field and theoretical investigations of geothermal systems in Italy and abroad. She coordinated for CNR the Italian geothermal evaluation projects, and led the participation of CNR and was WP leader in many EU projects dedicated to geothermal energy, regarding exploration methods development, coordination of research efforts and geothermal networking, and promotion and support for the development of geothermal energy. She is active in international strategic geothermal associations for R&I in the geothermal sector (EERA-JPGE, EGEC, ETIP DG). Author and co-author of publications on national and international scientific journals and proceedings of conferences/workshop, convener at national and international conferences, lecturer in international geothermal courses, conferences, schools and workshops, and reviewer for many international journals in geophysics and geothermal exploration research.

Beside her job, she loves to read, to paint, to knit, to bike, and to be a mother, a gardener and a cats' friend.

Abstract


I gave lectures regarding geothermal energy, its applications and connected environmental aspects. My intent was to provide information related to this important form of renewable energy sources, which plays an important role in Italy and may find important applications also in the countries participating to the DIPLOMAZIA project, discussing the associated environmental and social issues. Lectures were theoretical, the slides have been distributed among the participants. I received many questions, and the students appeared very interested in most aspects.

In consideration of the activities I am currently carrying out in the geothermal sector, and my experience in project development, I was asked to train one of the student. The activities were focused on defining geothermal market, broadening the perspective of environmental aspects of geothermal with respect to what was already available and requirements for enhancing Human

Capacity Building in the sector. Two reports have been the results of this technical activity: a) Learning needs for education in geothermal energy, and b) Potential impact of geothermal energy on ecosystem, biodiversity and environment, including regulatory aspects.

It has been interesting to carry on this training, both on the technical and cultural level. Different perspectives (my earth science background and scientific experience with respect to biology background and governmental support of the student), different cultures, common values, management strategies were often debated, with some interesting insights. I think that we had mutual benefit from our common experience.

GIULIO MASETTI
CNR – IGG, Lecturer

	<p>BIOSKETCH</p> <p>Giulio Masetti has a degree in Geological Science and works as a Technologist at the Institute of Geosciences and Earth Resources (IGG) at Italian National Research Council (CNR), operating as GIS expert in applied research projects mainly concerning groundwater characterization and protection. He is the Head of IGG’s “GIS, Cartography and Remote Sensing” Laboratory (LabGIS) and the Scientific coordinator for the IGG activities concerning the maintenance and management of the Tuscany Region geological databases.</p>
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Abstract

Geographic Information Systems (GIS): tools and methods for spatial data management and analysis.

The main goal of the lesson was to provide an overview of what GIS are and what they can offer in order to manage and process spatial data; as a matter of fact, being the most efficient system for storing, analyzing and managing spatial databases (geodatabases), Geographic Information Systems are crucial to interpret the environmental data.

Given the short time available the lesson focused more on the practical and operative aspects, leaving aside more theoretical arguments (e.g. coordinates systems, projections, ...).

First, were given some basic principles explaining what the georeferencing layers are and how GIS represents the observed reality by overlapping layers. Moreover, some fundamentals concerning map algebra and spatial analysis were introduced, in order to explain how spatial data can be queried, selected and analyzed using powerful mathematical, logical and statistical operators and functions, not only on the basis of their spatial properties and attributes, but exploiting the mutual spatial relationships, also on the basis of the spatial properties and attributes of other existing thematic databases. Furthermore, some examples were presented to show how operating GIS offers numerous opportunities to increase the geodatabase's reliability compared to the limitations presented by all the other available thematic geodatabases, allowing mutual control and validation.

Next, there were explained the main properties of vector and raster data models; main advantages and disadvantages of the two data models were listed in order to discuss which kind of data are suitable to represent and how the resolution of spatial data is directly linked to the accuracy of the representation, describing its greater or lesser ability to faithfully reproduce reality.

Afterwards, with reference to vector layers, Topology was introduced as a set of spatial rules ensuring correct geometric relationships and describing how features exist in relationship to their neighbors, followed by some examples.

Additionally, it was discussed about data management and analysis, the many different possibilities to visualize and represent data were shown as a key to highlight the attributed characteristics and to analyze the mutual spatial relationships, showing patterns and trends. The different ways to query and select data were discussed as well by providing some basic concepts about the *Standard Query Language (SQL)*.

After some hints about editing, it was discussed geoprocessing as a set of tools and procedures for processing spatial data, both vector and raster data. The main geoprocessing tools and geoalgorithms were also introduced, succeeded by specific examples. When explaining raster geoprocessing, Map Algebra was illustrated and the main operators and functions were analyzed, too. In addition, statistical surfaces were introduced, distinguishing between deterministic and geostatistical spatial interpolation techniques.

At last, the different morphological and morphometric Digital Elevation Models analysis were illustrated introducing the main geoalgorithms and providing specific examples.



BIOSKETCH

Matia Menichini received a degree in Geological Science *cum laude* at the University of Pisa in 2006 and achieved her PhD in Earth Science in 2012 (Galileo Galilei PhD Program - University of Pisa). She is currently serving as a researcher at the Institute of Geoscience and Earth Resources of Pisa (Italy).

Main research activities concern the characterization, the quantitative and qualitative degradation, safeguard and strategic role of water resources in the framework of the research program “water resources protection and contaminants traceability”. Such as activities are developed by means of an integrated approach that involves structural/geological, hydrogeological, geochemical/isotopic, and also numerical modeling tools.

Abstract

The main object of the lessons was to describe and to deal with the methodology and procedure for constructing mathematical model from hydrogeological conceptual model. The main topics discussed started from the meaning of “Model”, the different type of model and the application of model, to a brief mathematical framework and description of the main Computer Code. How to build a groundwater flow and transport model (spatial and temporal discretization, boundary conditions, hydraulic properties, sinks and sources ...) were also explained. Finally, the issue of sensitivity analysis, calibration and validation, as well as, the model uncertainty were faced. At the end of these theoretical lessons some cases studies were presented: 1) A multidisciplinary approach to define the hydrogeological model of aquifer systems in the "Fiume Versilia" catchment and the adjacent coastal plain (Northwest Tuscany, Italy); 2) Development of a groundwater flow model using an open source graphical user interface (FREEWAT, H2O2O project) of the Follonica aquifer system (Southern Tuscany, Italy); 3) Groundwater flow controlled by rivers and implications with future climate scenarios: a predictive modelling for the Magra Valley aquifer (South-East Liguria, Italy).

The internship program, titled “*Integrate water Isotopes into hydrogeological studies for developing groundwater models and understanding mechanisms*”

of contaminations from seawater intrusion and landfill leachate: the case study of the Pisa Plain aquifer system (W-Tuscany)” included a first phase of field activities for the measurement of some hydrogeological and physical-chemical parameter, and to perform water sampling, well vertical logs, etc. In the first phase of the program, specific geodatabase to organize and to manage a great quantity of stratigraphic, hydrogeological, geochemical and isotopic data was created. Subsequently, the data available were elaborated to understand the hydrodynamic and individuate the main processes that occur in the area of interest. Groundwater Modeling exercises were conducted to acquire familiarity with the construction of numerical model and modeling tools.

The topics covered in this training project have allowed to acquire some knowledge and tools useful for a correct management and sustainability of groundwater resources, especially in a changing world.

MADDALENA PENNISI

CNR – IGG, Lecturer



BIOSKETCH

Maddalena Pennisi, PhD at Paris XI University, Senior research at IGG-CNR.

Her main research interest is in fluid geochemistry. She has long experience on the monitoring of active volcanoes, on isotope applications to hydrology, and on geothermal systems.

She played volleyball and won a national (1979-1980) and a little league (1978-1979) championship. She enjoys field work, traveling, gardening and staying with kids.

Abstract

The goal of the frontal lesson “*Boron and Strontium, a stable and a radiogenic isotope: application to hydrology*” has been to show the powerful role played by a multi-isotopic approach in hydrology, with a special interest to boron and strontium isotopes. These elements were in last decades widely applied by IGG researchers, in projects aimed at tracing sources and processes in the field of hydrology. We started with a general overview on water resources, on the water-gas-rock interaction and on the hydrological cycle of water and dissolved elements, both looked from a geogenic and anthropogenic point of view. We introduce the global use of water in terms of withdrawn and food production.

The mobility, bioavailability and toxicity of these elements were taken into account and discussed in the frame of the main hydrological facies of water, exploited for domestic uses. The concept that “*no plan B exists for water*” was used to introduce isotopic geochemistry as a powerful tool to investigate the origin meteoric recharge and of the dissolved elements. A theoretical approach on isotope geochemistry was given, underlying the main role played in the '60 of 1900 by the Pisa scientists, who started isotope geochemistry in Italy and applied in the field of hydrology, geochronology, and geothermal resources. We introduced boron and strontium, as common constituent of silicates, soils, plants and continental water, sea water, and anthropogenic sources, discussing their geochemical behaviour in aqueous fluids, and their role to track fluids in the mantle, lithosphere, and hydrosphere. The basic principles of isotope geochemistry of boron and strontium In fluids have been explained: a) boron, in fluids and in rocks is linked to oxygen, and its distribution of $B(OH)_3$ and $B(OH)_4^-$ in water is mainly controlled by pH and salinity, b) strontium isotopic signature reflects the mother rocks, and distinguish between the main geologic reservoirs. These basic principles were followed by examples from published works on the application of boron and strontium isotopes to water studies. In particular, we present results gained by the EU project Boremed, PRIN-Ravenna (Emilia Romagna, Italy) and Etna (Sicily, Italy) case studies. The IGG Thermal ionization Mass Spectrometry laboratory, consisting of four clean rooms (class 1000-100) and two mass spectrometry, as well as the analytical protocols followed to performed the analyses were also discussed. In conclusion, the Isobordat database, organized and updated by IGG was presented as a useful support for any future application of the boron isotopic systematic to hydrology.

FABRIZIO PIANA

CNR – IGG, Lecturer



BIOSKETCH

Field geologist working since 1986 mainly (but not only...) on sedimentary or very-low grade metamorphic rocks.

Main researches: geological mapping, tectono-sedimentary evolution of Alpidic orogens, structural analysis and fracture network modeling, neotectonics; geological risk analysis (tunnels, dams, landslides), asbestos-bearing rocks management; geo-database and ontology design.

	Other skills: viticulturist and wine-maker, guitar player, biker and runner.
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Abstract

Title: Some very basical geological elements to approach hydrostratigraphic issues

The lesson concerned on: rocks and geological setting of regions (3D geological domains which can be aquifers).

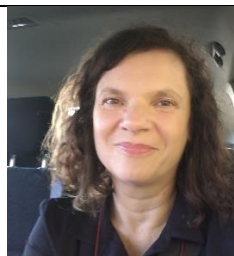
Main concepts illustrated:

- Geological regions are made of rocks and Groundwaters are stored in rocks.
- Rocks have physical properties that influence water storing and water flow: Porosity of a rock is a measure of its ability to hold a fluid. It is expressed as a percentage of the rock which is taken up by pore space. Permeability of a rock is a measure of the resistance to the flow of a fluid through a rock.
- Knowledge of geological settings (regions) allows predicting where and how groundwaters are stored.
- Groundwater are stored in geological bodies: the *aquifers*. Aquifers are to be thought as real geological objects (e.g. “**sedimentary basins**”), whose shape depends on the geological setting of the region.
- Aquifer types are many and variable because geological sedimentary basins develop in different contexts within the Earth’s crust
- Sedimentary basins forms on both continental and oceanic crust, such as in front of orogenic collisional chains.
- Each sedimentary basin has its own depositional history and tectonic evolution
- The Geometry of the aquifers depends on the geological setting of the sedimentary basin (stratigraphic architecture and fault network) and the Composition of groundwaters depends on rock types.

Some cases of sedimentary basins in Europe, America and Australia have been illustrated, to enhance that Integrated Geological Models are needed and essential for hydrostratigraphic analysis.

BRUNELLA RACO

CNR – IGG, Coordinator and Lecturer



BIOSKETCH

The main objectives of the research carried out by Brunella Raco, was addressed to the use of Geochemistry for the mitigation of the risks of volcanic eruptions, limnic eruptions, as well as for the exploration and exploitation of geothermal resources and for environmental forensic and pollution fingerprinting. She participated to several projects and works focused on the evaluation, the fingerprinting and the mitigation of the environmental impact generated by anthropogenic sources (industrial facilities, landfills, mining districts), in the evaluation of geochemical baselines, in the evaluation and protection of natural resources. In the last years, the activity research has been focused on the protection of water resources and on the fingerprinting techniques to identify the origin and the fate of contaminants. These research activities were performed in cooperation with researchers working for different institutions, in the framework of several projects, at regional, national, and European level.

Abstract

The lessons have regarded two main topics: the use of geostatistical techniques for geochemical mapping and how to assess the environmental impact of landfills.

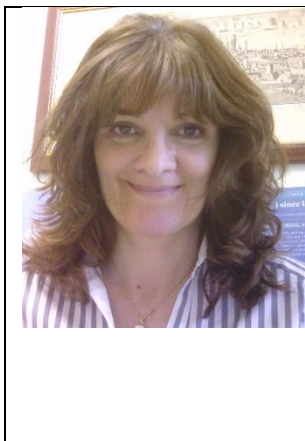
The first lesson introduced to practical geostatistic, starting from the meaning of regionalized variables, passing through the semivariogram tool and the interpolation techniques such as the Kriging technique. Examples of data processing have been also presented during the lesson, starting from the calculation of experimental variogram, the construction of mathematical fitting model of the experimental semivariogram and the selection of the best neighborhood to be considered for the interpolation process. The aim of this lesson was to point out that at the base of geochemical mapping there should be a mathematical criterion and that the geostatistical method allows to evaluate the degree of confidence of the maps obtained.

In the second lesson a method procedure to investigate the environmental impact originating from MSW (Municipal Solid Waste) landfills have been given. This procedure is based on the combination of chemical and isotopic

analyses of the fluids. This kind of procedure offers enough information to get a detailed picture of the environmental state of landfills and their neighborhoods and, in particular, the interaction among landfill pollution vectors (leachate and biogas) and environmental matrices (water, air). Also the European Directive known as “Landfill Directive” (1999/31/CEE) has been presented during the lesson. This Directive is the result of a political and legislative effort aimed to provide care and responsibility on environmental quality and public health prevention issues, with specific reference to the problem of waste disposals and environmental monitoring. In several European countries, MSW landfills represent one of the most serious threats for the environment, because of their number, their distribution on the territory and their size growth. Thanks to Diplomazia2 this last argument has been the object of a bilateral project Italy-Libanon.

LISA PIEROTTI

CNR – IGG, Lecturer



BIOSKETCH

Postdoctoral Researcher at the Institute of Geosciences and Earth Resources (IGG) of the CNR (National Research Council of Italy). His work has centered around the fluids geochemistry, with particular regard to the study of earthquake geochemical precursors. She is technical manager of IGG-Laboratory “Development of Geochemical Automatic Monitoring Systems” and scientific coordinator of the researches concerning the geochemical monitoring network installed in the areas with the highest seismic risk of Tuscany, Italy. Her main passion is to play the liturgical organ.

Abstract

The theoretical lesson has been about the continuous automatic monitoring of deep water by automatic stations. The instrumentation that performs the measurement of temperature (T; °C), oxidation-reduction potential (ORP; mV), electrical conductivity (EC; microS/cm), pH and dissolved gases (CO₂ and CH₄) has been described. The acquisition system and data transmission, along with some example of data processing have been discussed.

MASSIMILIANO ALVIOLI

CNR – IRPI, Lecturer



BIOSKETCH

Massimiliano Alvioli graduated in Physics in 2003 and currently works at the Italian National Research Council, Research Institute for Geo-Hydrological Protection. He deals with numerical modeling of landslides on a large scale, mainly with physically based models and quantitative methods in general. He likes to apply parallel and distributed computing techniques borrowed from his Physics background, and from the High Performance Computing world, to the Geo-Sciences domain in a broad sense.

Abstract

GEO-HYDROLOGICAL PARTITIONING OF THE TERRITORY and SLOPE STABILITY MODELS

During the lecture, we discussed two topics in relation to the work developed at CNR IRPI, namely: (1) methods for geo-hydrological partitioning of slopes, and (2) slope stability models for shallow landslides.

Topic (1) was framed within the methods of hydrology. In this framework, a Digital Elevation Model (DEM) is used to calculate the effects of gravity on the water flow, and other factors are disregarded [1]. Land-surface parameters, calculated from the DEM or otherwise available, describe water flow and can be used for many different applications. Key parameters are slope, aspect, curvatures, roughness. Mostly relevant for our purposes is contributing area (or flow accumulation) which is used to define land-surface objects like drainage networks, channels, basins, half-basins. Such objects, in turn, are useful to define landforms and mapping units. Terrain units (TU) are a subdivision of the terrain that maximize the within-unit (internal) homogeneity and the between-unit (external) inhomogeneity across distinct physical or geographical boundaries [2,3]. A slope unit (SU) is a type of morphological TU bounded by drainage and divide lines [2,3,4]. SU delineation presents different challenges and automatic delineation is difficult to achieve. Methods based on drainage networks can be implemented at different coarseness levels, defined by a well-defined value of flow accumulation [4]. The r.slopeunits software introduced in Ref. [4] is an iterative algorithm providing adaptive SU delineation using input parameters provided by the user. At each iteration half-basins are calculated with a given

flow accumulation value, and are checked against parameter values (homogeneity, size). Half-basins not meeting the requirements are split further at next iteration, using a smaller flow accumulation value. Values of input parameters can be optimized with proper metrics for the particular purpose. For landslide susceptibility, a combination of an aspect segmentation metric and AUC_{ROC} was devised for parameter optimization in [4].

Topic (2) was discussed in rather general terms. We defined a landslide as the movement of a mass of rock, debris, or earth down a slope, under the influence of gravity [6]. Shallow landslides are caused primarily by rainfall and pore pressure changes [7]. In particular, we described the Transient Rainfall Infiltration and GRid-based Slope stability model – TRIGRS [8,9,10]. Deep-seated landslides require different models, *e.g.* r.slope.stability [11,12]. Within TRIGRS, shallow landslides are described within the infinite-slope approximation, for saturated and unsaturated conditions, and slope stability is assessed by a factor of safety, F_s . The stability of a grid cell on a slope is governed by the balance of vertical component of gravity (F_c) against the resisting stress due to basal Coulomb friction (F_f), plus pore pressure (F_w). Failure occurs at depth Z , measured vertically from the surface, if at that depth: $F_s = F_f + F_w + F_c < 1$. Calculation of F_s require knowledge of hydrological and geo-technical parameters of the soil. We described a probabilistic approach for the determination of parameters based on Monte Carlo sampling of suitable probability distributions. Probability distributions were estimated by means of field measurements [9,11]. The model output can be validated against known rainfall events that have caused shallow landslides. The original model is deterministic, *i.e.*, it provides a single output. The described probabilistic approach provides several outputs. Statistical analyses are performed on multiple results of the probabilistic runs, initialized with a random set of parameters sampled from the specified probability density function. Large areas can also be modelled by parallel processing techniques. Parallel processing also allows multiple simulations with different input parameter values in a short time [8,11].

References

- [1] T. Hengl, H. I. Reuter - Geomorphometry. Concepts, software, applications. Developments in Soil Science, vol. 33, Elsevier (2009) 772 pp.
- [2] A. Carrara, M. Cardinali, R. Detti, F. Guzzetti, V. Pasqui, P. Reichenbach – GIS techniques and statistical models in evaluating landslide hazard – Earth. Proc. Sruf. Land., 16 (1991) 427
- [3] F. Guzzetti, P. Reichenbach, F. Ardizzone, M. Cardinali, M. Galli - Estimating the quality of landslide susceptibility models – Geomorphology, 81 (2016) 166
- [4] M. Alvioli, I. Marchesini, P. Reichenbach, M. Rossi, F. Ardizzone, F. Fiorucci, F. Guzzetti - Automatic delineation of geomorphological slope units with r.slopeunits v1.0 and their optimization for landslide susceptibility modeling - Geosci. Model Dev. 9, (2016) 3975

- [5] M. Rossi, P. Reichenbach – LAND-SE: a software for statistically based landslide susceptibility zonation, version 1.0 – Geosci. Model Dev., 9, (2016) 3533
- [6] D. J. Varnes – Slope movement types and processes - In: Special Report 176: Landslides: Analysis and Control (Eds: Schuster, R. L. & Krizek, R. J.). Transportation and Road Research Board, National Academy of Science, Washington D. C., (1978) 11
- [7] M. Alvioli, M. Rossi, F. Guzzetti - Probabilistic approach to physically based landslide modeling - in ICL Teaching Tools, Ed. by Sassa et al. (2015), p. 369. ISBN: 978-4-9903382-2-0
- [8] M. Alvioli, R.L. Baum – Parallelization of the TRIGRS model for rainfall-induced landslides using the message passing interface – Env. Modell. Soft. 81 (2016) 122
- [9] M. Alvioli, F. Guzzetti, M. Rossi – Scaling properties of rainfall-induced landslides predicted by a physically based model – Geomorphology 213 (2014) 38
- [10] S. Raia, M. Alvioli, M. Rossi, R.L. Baum, J.W. Godt, F. Guzzetti – Improving predictive power of physically based rainfall-induced shallow landslide models: a probabilistic approach – Geos. Model Dev. 7 (2014) 495
- [11] M. Mergili, I. Marchesini, M. Alvioli, M. Metz, B. Schneider-Muntau, M. Rossi, F. Guzzetti - A Strategy for GIS based 3D slope stability modelling over large areas – Geosci. Model Dev. 7 (2014) 2969
- [12] M. Mergili, I. Marchesini, M. Rossi, F. Guzzetti, W. Fellin – Spatially distributed 3D slope stability modelling in a raster GIS – Geomorphology 206 (2014) 178

Software

<http://geomorphology.irpi.cnr.it/tools/slope-units>

<https://github.com/maurorossi/LAND-SE>

<https://github.com/usgs/landslides-trigrs>

<http://www.slopestability.org>

DOMENICO CASARANO

CNR – IRPI, Lecturer



BIOSKETCH

Laurea degree in Physics (Università di Bari) in 1994; PhD in Physics in 1999; since 2001 technologist with the CNR-IRPI Bari.

His main research field is the analysis of environmental processes integrating GIS, remote sensing, field measurements and physical modeling, with applications to slope instability, analysis of time series of climatological and hydrogeological data, assessment of groundwater aquifer vulnerability. He is involved in the analysis of Cassini mission (NASA-ESA-ASI) radar data on Titan as a member of Cassini Radar Science Team.

	He enjoys reading (especially about sciences, history and arts), music, cinema and riding bicycle. He is interested in photography and astronomy and he likes vintage cars, bikes and cameras.
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Abstract

Geographic Information Systems (GIS) can find many applications in the Environmental Sciences. The aim of the lecture has been to introduce the basic principles of GIS and to give an overview of their main capabilities and functionalities. The objective has been to give practical examples of applications, in order to allow the attending students, working on different fields of the Environmental Sciences, to find links and applications to the object of their activity.

The main characteristics of the geographic data frame, such as coordinate systems, as main properties of vector and raster databases were shown: geometry, attributes, editing, selection, and processing. Selection and map representation based on feature attributes were introduced, as well as format conversion and use of the same information in both vector and raster data set, using interpolation, contouring and point value extraction. Examples of 3D representation and shaded relief were provided. The main functions of spatial and statistical analysis of raster data were presented, with use of arithmetic and logical operators, and two-raster crossed statistics. Applications to climatology and hydrology were briefly introduced, as well as the use of GIS in combination with modelling software, to generate input parameters grids and to display and analyze model outputs.

PIERNICOLA LOLLINO

CNR – IRPI, Coordinator IRPI (Bari) activities and lecturer



BIOSKETCH

Dr. Piernicola Lollino is a research engineer at CNR-IRPI (National Research Council - Institute for Geo-hydrological Protection) in Bari, Italy. He is currently also the Person on charge of the IRPI Section of Bari. He holds a PhD in Geotechnical Engineering and has been visiting PhD student at the Imperial College, London (UK); he has also been visiting scientist at the Universidad Politecnica de Madrid, Spain, where he is currently co-supervisor of a PhD program.

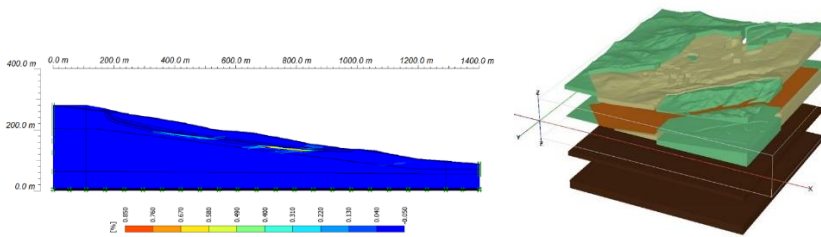
	<p>His main research interests are in the field of geotechnical engineering, engineering geology, natural hazards, ranging from numerical modelling applications to field monitoring and laboratory testing. He has covered a broad spectrum of research topics ranging from slope instability and landslide assessment, propagation of long run-out landslides, sinkhole hazard assessment, stability of rock slopes, analysis of the behavior of old embankment dams. He has been involved into several international and national research projects and has been contract professor of several courses at the Politecnico di Bari and University of Bari.</p> <p>His preferred hobbies are travelling and sports; he likes playing tennis and swimming.</p>
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Abstract

Addressed topics: Landslide monitoring innovative techniques, soil and rock mechanics: basic principles, geotechnical modelling of slope stability and underground cave stability

The first lecture presented the approach of using advanced instrumental techniques to monitor the ground displacement field related to landslides or different ground instability processes along with some example of applications of these techniques to interesting case studies (landslides, subsidence, earth-dams). The emphasis was on the exploitation of LIDAR, Robotized Total Stations, Ground-based SAR, Global Positioning Systems to detect the displacement field of landslides, subsidence processes and earth-dams. The second lecture was focused on the basic principles of soil and rock mechanics that can be useful for any engineering problems involving soil and rock masses. Finally, the third lectures was aimed at showing the geotechnical modelling as a powerful method to gain an interpretation of the failure process or the strain mechanism of landslides and sinkholes, as well as to derive information on the most important factors that control these instability processes. In particular, the lectures provided background information and many examples of applications of geotechnical modelling techniques, highlighting the difference between using two-dimensional and three-dimensional techniques.

The lectures are supposed to be well related to the major aim of Course 1 - Diplomazia2, since they were aimed at providing useful information on tools and techniques to face environment/climate change/resilience problems, with reference to the corresponding effects on soil and rock instability processes within the Mediterranean Area.



Examples of two-dimensional and three-dimensional numerical models to study landslide processes.

ROSA PAGLIARULO

CNR – IRPI, Lecturer



BIOSKETCH

After graduating in Geological Science from the University Aldo Moro of Bari in 1977, she joined as a Researcher the Research Institute for Geo-Hydrological Protection (IRPI) of the Italian Consiglio Nazionale delle Ricerche (CNR) since September 1987. From 2013 to 2015 she has been the Section Head of IRPI Unit in Bari. She participated in a number of national and international Research Projecst and is Author and Co-Author of more than 130 papers in national and international journals.

The main research interests include: Quaternary geology, landslide and coastal hazard assessment, subsidences in alluvial coastal plains, geological and geotechnical influences on cultural heritage, glacioeustatism, sea level changes and the impact on coastal areas, petrographic and geo-mechanical characteristics of carbonatic rocks.

She is interested in music, literature , cinema, theater and spending leisure time open-air.

Abstract

The topics “Geological outlines of the Apulian region in the geodynamic evolution of the Southern Italy” and ”Coast instability problems” have been discussed in two lessons. A brief reconstruction of the paleogeographic evolution of Central Mediterranean area has been described to focus the attention to the Southern Apennines thrust belt, a roughly NW-SE oriented

segment of the Apennines, located in the hanging wall of a W-directed and E-retreating subduction of the Apulo-Adriatic lithosphere. The main geodynamic factor controlling Italian tectonics is the relative motion of Africa and Europe as a consequence of different spreading rates along the Atlantic oceanic ridge. The Central Mediterranean area is a complicated puzzle from the point of view of plate tectonics.

In this frame the Foreland comprises the Adriatic Sea, the subsurface and the Apulia plateau. It has been a passive margin of what has been interpreted as a promontory of the African plate. Adria is considered a micro-plate and a piece of the African continent which is wedged along the Adriatic Sea and the Po Plain. Present day tectonic shows that the Adria Plate moves in a NNE direction with a component of counter-clockwise rotation, GPS measurements estimate this movements in 5 mm/yr.

Apulia region is the emerged part of the Adria plate which constitutes the foreland of both Apenninic and Dinaric orogens. It comprises a Variscan basement covered by a 3-5 km thick Mesozoic carbonate sequence: the Calcari delle Murge unit and the shelf carbonate sequence outcropping in the Gargano headland, overlain by thin deposits of Neogene and Quaternary age. The Apulian foreland is weakly deformed and affected by Apenninic (NW-SE) and anti-Apenninic (NE-SW) trending faults which subdivide it into five main structural blocks characterized by different landscapes and uplift rates: Daunia, Gargano, Tavoliere, Murge, Taranto-Brindisi plain and Salento peninsula.

The second lesson has been focussed to the instability processes affecting the Apulian coastal areas and the related hazard with special reference to the rocky coasts.

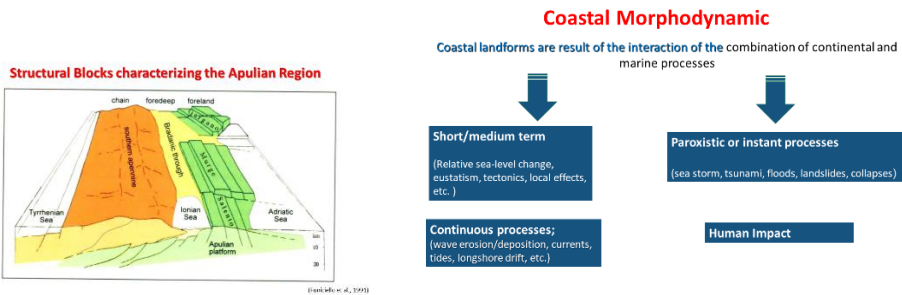
The rocky cliffs are affected by erosional processes, which are worsened by complex mechanisms of interaction between the gravitational forces and the sea actions, leading to coastal retreats. The coast comprises sub-vertical or overhanging cliffs, gently sloping rock shores, wave cut platforms and sand beaches. The steep plunging cliffs are cut mostly into Cretaceous limestones and Pleistocene calcarenites.

The steep plunging cliffs are cut through limestones and calcarenites with variable high from 7 up to 14 -20 meters. The sloping and flat coasts are the most widespread morphological types. The flat sloping coasts are made up of a low, gently shore platform cut into fine grained fossiliferous limestone and medium grained biocalcarenes. The high relief (headland) coasts have a convex profile. Karstic landforms are represented by caves, canalizations,

sinkholes, arches, stacks and coastal quarries that characterized areas of weakness in the coastal stretches. All the factors influencing the instability processes in the short, medium and long term have been taken into account.

The main instabilities are ascribable to rock falls, toppling, slides and wedge failures. Falls of blocks and big slices of rocks are triggered by undercutting at the base of the cliff due to the strong impact of the sea erosion. In this case the presence of wave-cut notches must be pointed out, especially when there is no wave cut platform.

The anthropogenic effect is not negligible. The touristic activities, taking place above all on summer season, and the presence of intensive development of infrastructures (properties, roads, etc.) interfere with the natural coastal evolution. This condition heavily loads the top of the cliffs also contributing to accelerated slope failure.



MAURIZIO POLEMIO

CNR – IRPI, Lecturer and Tutor



BIOSKETCH

He is a Scientist - CNR researcher - from 1992 and was the Person on charge of the IRPI Dept. of Bari from 2007 to 2013. He is the person on charge of the Hydrology Laboratory and of Hydrogeological Research Group of CNR-IRPI.

He has matured expertise, applying steady attention to practical and engineering aspects of studied phenomena and pursuing the quantitative characterisation of them, on main topics as: quality and quantity degradation, groundwater vulnerability, groundwater overexploitation; hydrogeological characterisation and monitoring of slopes; numerical modelling of groundwater

	flow, also for slope stability analysis; geostatistics e hydrological statistics of hydrogeological time series; relationship between rainfall and recurrence of damaging hydrogeological events as landslides and floods; protection against Impacts of climate change.
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Abstract²

Groundwater constitutes the 30% of the freshwater resources. Since only 1.2% of the freshwaters are found in surface, the world population highly depends on the groundwater resource. Therefore, it is relevant to study, protect and manage it because it's degradation by overexploiting (quantitative degradation) or by polluting (qualitative degradation) will put at risk our own existence. The lessons were well suited to give a complete picture of 1) the groundwater (flow, pollution), 2) theory of how and under which conditions (e.g. Ghyben-Herzberg approach) does happen the seawater intrusion into coastal aquifers, degrading so their quality; 3) relationships freshwater-saltwater in different types of coastal aquifers (including practical example of Salento Peninsula); 3) Management approaches for coastal GW resources which are of three types: engineering approach, discharge management approach, water and land management approach. The complexity and areal extent increases going from the first to the last management approach. 4) Recharge and Discharge of confined or unconfined aquifers. 5) Practical illustrations of Italian aquifers were given: limestone or carbonate aquifers (Gargano, Murgia and Salento) and porous aquifers (Tavoliere). 5) Climate change and groundwater are related in the fact that it may influence the recharge trend of an aquifer. Recharge trend and Discharge trend determines the risk of overexploitation. Adaptation measures are necessary because future scenarios are unsustainable. 6) Approaches how to reduce the risk of Groundwater quality Degradation due to Seawater Intrusion (GDSI) were given, such as the threshold approach, defining of management criteria, numerical modelling to assess the effect of criteria. There are three sensitivity or risk grades of GDSI: Remarkably protected, intermediate, permanently damaged. 7) In the "Groundwater resources and exploitation" lesson we learned about aquifer vulnerability to pollution and methods how to assess it. SINTACS assessment model of ground water vulnerability was explained in detail. Assessment results were used as illustration. In conclusion, the lesson was very useful and was significantly related to the major aim of Course 1, Diplomazia.

² The abstract was fully written by some Diplomazia's student. I sincerely appreciated their contribution

FRANCESCA SANTALOIA

CNR – IRPI, Lecturer and Tutor



BIOSKETCH

Researcher in Engineering Geology at the Research Institute for Geo-hydrological Protection of the National Research Council (CNR-IRPI). Degree in Geology (Bari University) and PhD in Engineering Geology (Milan University). I collaborate with some Italian universities, polytechnics and research institutes and participates to research projects. My research activities are mainly focused on engineering geology and hydrogeological subjects: soil mechanics, landslides analysis and monitoring, karst aquifers and geothermal resources. During her activity, the geological setting and evolution of the landslide areas, as the failure mechanism of the unstable slopes, result mainly from the field surveys, in situ and laboratory investigations field monitoring and slope stability analyses.. During the years, I have analyzed the mineralogical and structural features' influence on the mechanical behaviour of structurally complex clayey successions. I have also developed geological analyses of coastal aquifers, aimed at their geo-hydrological characterisation and at their monitoring through experimental field, and analysis of erosion processes acting on silty-clayey slopes. Recently I am involving in geological and geo-hydrological studies of geothermal areas.

Abstract

I have given some lessons concerning the following topic: Landslide Risk Evaluation (Geo-mechanical landslide hazard, element at risk and vulnerability), Landslide monitoring (geomorphological slope studies, inclinometer monitoring), Soil characterisation (physical and index properties, soil structure and clay minerals).

I was the tutor of Alia Amer who has collaborated with me and some other participants to some research projects, involving the CNR-IRPI and the Technical University of Bari. This project is on landslide risk mitigation, pursued by three main actions. The first one concerns the analysis of the slope processes for the interpretation of the landslide mechanism. The second one deals with the selection, design and validation of the sustainable strategies to mitigate the landslide damaging effects whiel the thirst one delas with slope

monitoring. Part of this project concerns slow and deep slope processes, whose activity tends to increase from the end of winter to the beginning of spring. These seasonal fluctuations are found to be often synchronous with the 180 day cumulated rainfalls (Fig. 7 ; Cotecchia et al. 2014b).

The activity of Alia Alia, together with the results obtained by her work, is included in both the first and the second actions of these projects. Therefore, she has worked on two weather driven and slow landslides, located in the southern Apennines. For instance she has worked on weather data and also in the field looking at the effect of deep-rooted bushes on the slope hydraulic regime tested in a small real scale test site.

JANUSZ WASOWSKI

CNR – IRPI, Lecturer



BIOSKETCH

Dr. Janusz Wasowski is a research geologist at CNR-IRPI (National Research Council - Institute for Geo-hydrological Protection) in Bari, Italy. He is also the Editor-in-Chief of Engineering Geology (Elsevier). Since 2011 he has held the positions of Visiting Professor at the Research School of Arid Environment and Climate Change, Lanzhou University, Gansu, China and of Science Officer of the Natural Hazards Group Programme, European Geosciences Union (EGU).

He is an internationally recognized scientist in the field of engineering geology, natural hazards and applied remote sensing. For over 25 years Dr. Wasowski's work has covered a broad spectrum of research topics ranging from slope instability and landslide assessment, collateral seismic hazards, geotechnical field investigation and in situ monitoring, to exploitation of air/space-borne remote sensing and geophysical surveying in engineering geology.

Abstract

SAR (Synthetic Aperture Radar) interferometry - geomorphological processes.

The lecture presented the use of information retrieved from remotely sensed data in geomorphologic research and related fields (geology, natural hazards). The focus was on the new tools and techniques of earth surface sensing, which hold the most promise for profitable exploitation in research and practice. The emphasis was on the exploitation of SAR (Synthetic Aperture Radar)

interferometry where the most innovation has been taking place since the beginning of this century.

In particular, the lecture provided background information and many examples of applications of advanced multi-temporal interferometry techniques in applied or engineering geomorphology. In settings with limited vegetation cover, these techniques can deliver precise (mm-cm resolution), spatially dense information (from hundreds to thousands measurement points/km²) on slow rate (mm-dcm/year) deformations affecting the ground or engineering structures. Radar satellites guarantee wide-area coverage (thousands km²); the sensors that actively emit electromagnetic radiation can see through the clouds, and the deformation measurements are rarely affected by bad weather conditions. The application examples included:

- Natural hazard (geologic/geomorphologic and hydrologic) assessment and monitoring (e.g., subsidence, landslides, ground deformations in general, floods)
- Monitoring human-induced hazards (e.g., landfill deformations, subsidence due to groundwater withdrawal)
- Monitoring engineering structures (e.g., stability of transportation infrastructure, dams) in areas prone to landsliding.

FRANCESCA ARDIZZONE

CNR – IRPI, Lecturer



BIOSKETCH

Francesca Ardizzone is researcher at the IRPI-CNR, in Perugia. Her research interests include: (1) implementation of geodatabase of geological, geomorphological and environmental data, (2) detection and mapping of landslides in different climatic, geological and morphological environments, (3) temporal forecasting of landslides, using multi-temporal inventory maps, (4) landslide impact analysis on human structure, (5) landslide risk assessment, (6) geological and geomorphological interpretation of ground deformation measured by satellite.

Abstract

Geomorphological mapping to assess landslide risk. Risk assessment is the final goal of many landslide investigations. Assessing landslide risk is a complex and uncertain operation that requires the combination of different techniques, methods and tools, and the interplay of various expertise such as geology and geomorphology, engineering and environmental sciences, meteorology, climatology, mathematics, information technology, economics, social sciences and history.

In assessing hazard the interest is on the area where landslides occur while ascertaining risk requires a change in the target. In establishing risk, the focus is on the asset that may suffer damage from a landslide. Varnes and the IAEG Commission on Landslides and other Mass-Movements (1984) established the following definitions: the specific landslide risk ($R_s = H \cdot V$) is the expected degree of loss due to a landslide, and is obtained by multiplying hazard and vulnerability. The elements at risk are the population, properties, economic activities in the area that can be affected by a landslide. Lastly, total risk is the expected number of lives lost, person injured, damage to property, or disruption of activity due to a landslide.

Two main approaches are possible: (i) a quantitative (probabilistic) approach, and (ii) a qualitative (heuristic) approach. Quantitative landslide risk analysis uses numerical values and mathematical methods to estimate objective probabilities, e.g., the probability of loss of life, or the probability of damage to a structure or infrastructure due to mass movements. Among the qualitative risk approaches Cardinali et al. (2002b) and Reichenbach et al. (2005) described an attempt to determine qualitative landslide risk levels in Umbria.

The method is based on the geomorphological interpretation of multiple sets of aerial photographs of different ages (a process of multi-temporal landslide mapping), aided by the analysis of historical information on past landslide events. The method involves the definition of the study area and the careful scrutiny of the “state of nature”, i.e., of all the existing and past landslides that can be identified in the study area. The possible short term evolution of the slopes, the probable type in the distribution and pattern of landslides. The information is used to estimate the landslide hazard, and to evaluate specific and total levels of landslide risk. More precisely, the method involves: (i) the preliminary definition of the extent of the study area, (ii) the compilation of a multi-temporal landslide inventory map, including landslide classification, (iii) the definition of landslide hazard zones, (iv) the assessment of landslide hazard, using a two-digit positional index, (v) the identification and mapping of the elements at risk, including an assessment of their vulnerability to different landslide types, (vi) the evaluation of specific landslide risk, using a

three-digit positional index, and (vii) the determination of total landslide risk levels.

References

Cardinali, M., Reichenbach, P., Guzzetti, F., Ardizzone, F., Antonini, G., Galli, M., Cacciano, M., Castellani, M. and Salvati, P. (2002a) A geomorphological approach to estimate landslide hazard and risk in urban and rural areas in Umbria, central Italy. *Natural Hazards and Earth System Science*, 2:1-2 57-72.

Reichenbach, P., Galli, M., Cardinali, M., Guzzetti, F. and Ardizzone, F. (2005) Geomorphologic mapping to assess landslide risk: concepts, methods and applications in the Umbria Region of central Italy. In: Glade, T., Anderson, M.G. and Crozier, M.J. (eds.) *Landslide risk assessment*. John Wiley, 429-468.

Varnes, D.J. and IAEG Commission on Landslides and other Mass-Movements (1984) *Landslide hazard zonation: a review of principles and practice*. The UNESCO Press, Paris, 63 p.

SILVIA BARBETTA

CNR – IRPI, Lecturer



Silvia Barbetta received the M.S. degree in Environmental Engineering with excellence in 2001. Since 2009 she is a Researcher at CNR-IRPI and her main research interests concern: real time flood forecasting modeling and predictive uncertainty assessment, discharge assessment at ungauged river sites, hydraulic risk assessment in flooding prone areas, flood wave routing modelling, hydrological and hydraulic modelling, hydro-meteorological monitoring, water resources management, bridges and levees vulnerability. She serves as reviewer for many international journals and has been co-author of more than 60 papers (journal and conference proceedings) and more than 50 scientific reports on the above topics. She has actively participated in several research projects in the frame of Italian and European programs and in collaboration with Italian and international institutions.

Abstract:

Flood forecasting and Predictive Uncertainty estimate to efficiently support the activities of Monitoring and Warning Systems in real-time.

Flooding is the most common environmental hazard worldwide, causing significant damages both in terms of economic losses and casualties. River floodplains, where several human settlements all over the world have

developed, are the most susceptible area to flooding. As a consequence, flood events monitoring and mitigation have become fundamental in order to ensure that the damages are within an acceptable limit.

The Flood Forecasting and Warning Systems (FFWSs) operating in real-time are the most widespread non-structural measure for flood mitigation. They include a hydro-meteorological data acquisition and transmission system and a forecast modelling system providing forecast flows and stages in river sections using as input the measurements provided by the hydro-meteorological system. Finally, FFWSs involve a threat-recognition and information-dissemination system. Flood forecasting are approached by using rainfall-runoff and/or flood routing modelling. The forecasting models provide important information on future evolution of floods, but all models are imperfect and uncertainty on what will happen still remains. How to deal with forecast uncertainty is the main issue to solve.

One way to address uncertainty estimate is by using the concept of ‘Predictive Uncertainty’, PU, introduced for the first time when Krzysztofowicz (1999) proposed the Hydrological Uncertainty Processor. PU represents the probability of occurrence of a future value of a predictant (water level or discharge) conditional on all the information that can be obtained on the future value at the time of forecast, usually provided by the forecasting models. Following Krzysztofowicz (1999), Todini (2008) proposed the Model Conditional Processor (MCP) for PU estimate in a more general way, which also allowed for multi-model approaches (Coccia and Todini, 2011). MCP is a Bayesian methodology that identifies the Normal Bivariate joint distribution of observations and forecasts transformed from the real space into the Normal space. PU is identified through the Bayes theorem. One main benefit of PU estimate is the estimate of the probability to exceed a fixed hydrometric threshold on which the alert system is typically based. Recently, the multi-temporal approach of MCP, MCP-MT, has been developed and tested on different case studies (Barbetta et al., 2016; 2017). Basically, MCP-MT answers to questions like ‘Which is the probability that the river dykes will be exceeded within the next 24 hours?’, ‘What is the probability that the real water level will be higher than a threshold at 24th hour from now?’, ‘Which is the most probable hydrometric threshold exceedance time?’. The application of MCP/MCP-MT for different case studies demonstrated that the PU assessment is one of the most appropriate approach to deal with forecast uncertainty because it is the best available knowledge on a future event based on all the available information and it provides a probabilistic forecast.

References

- Barbetta, S., Coccia, G., Moramarco, T., Todini, E. (2016). 'Case study: a real-time flood forecasting system with predictive uncertainty estimation for the Godavari River, India', *Water*, 8(10), 463, doi:10.3390/w8100463.
- Barbetta, S., Coccia, G., Moramarco, T., Brocca, L., Todini, E. (2017). 'The multi-temporal/multi-model approach to predictive uncertainty assessment in real-time flood forecasting', *J. of Hydrol.*, 551, 555-576, <http://dx.doi.org/10.1016/j.jhydrol.2017.06.030>.
- Coccia, G., Todini, E. (2011). Recent development in predictive uncertainty assessment based on the model conditional processor approach, *Hydrol. Earth Syst. Sci.*, 15, 3253-3274, doi: 10.5194/hess-15-3253-2011.
- Krzysztofowicz, R. (1999). Bayesian theory of probabilistic forecasting via deterministic hydrologic model, *Water Resour. Res.*, 35, 2739-2750.
- Todini, E. (2008). A model conditional processor to assess predictive uncertainty in flood forecasting. *International Journal of River Basin Management*, 6:2, 123-137, doi: 10.1080/15715124.2008.9635342.

FEDERICA FIORUCCI

CNR – IRPI, Lecturer



BIOSKETCH

Federica Fiorucci received a degree in Geology in 2003, and a Ph.D. in Earth Sciences (geomorphology) in 2012 at the University of Perugia. She working on the use of remote sense data for landslide identification and mapping. Her research interests include: (1) the production of digital geographical databases of geological and environmental data, (2) the production of event landslide inventory maps, and multi-temporal landslide inventory maps, 3) Methods for landslide susceptibility, hazard and risk assessment, (4) and geomorphometry.

Abstract

NEW TOOLS FOR LANDSLIDE MAPPING

Landslides are a serious hazard in many areas of the World. Despite their importance, landslide maps cover less than 1% of the landmasses, and systematic information on the type, abundance, and distribution of landslides is lacking. New and emerging techniques based on satellite, airborne, and terrestrial remote sensing technologies, promise to facilitate the production of landslide maps, reducing the time and resources required for their compilation and systematic update. During the lesson, we examined new technologies for landslide mapping, considering in particular (i) the exploitation of very-high resolution digital elevation models to analyse surface morphology, (ii) the visual interpretation and semi-automatic analysis of different types of optical satellite images, comprising panchromatic, multispectral, and synthetic aperture radar images, and (iii) tools that facilitate landslide field mapping.

Quantitative descriptions of the topographic surface obtained from the LiDAR sensor offers a competitive advantage over other methods based on the visual interpretation and analysis of optical aerial or satellite images that do not penetrate the canopy. Visual analysis and interpretation of the topographic surface remains the most common and most promising application of a very-high resolution DEM captured by LiDAR sensors. Mapping proved effective in cultivated and in forested terrain, and to identify old and recent landslides. A few investigators have attempted to use very-high resolution LiDAR DEMs for the automatic or semi-automatic recognition of landslide features. This is a challenging task that, where successful, facilitates the production of landslide maps, chiefly landslide event inventories prepared after a specific landslide-triggering event. When landslides occur, they can change the land cover, modifying the optical properties of the land surface. Optical satellite sensors can measure the variations in the spectral signature of the land surface, and the images captured by satellite sensors can be used to detect and map landslides. Visual interpretation of optical images and derivative products (panchromatic, composite, false-colour, pan-sharpened) aims at substituting aerial photography (black & white, colour, infrared) for the identification and mapping of landslides.

Landslide mapping using semi-automatic classification technique is a classification problem. Landslides, particularly fresh landslides, are – from a radiometric point of view – different classes of the land cover, similar to built-up areas, forests, water bodies, and land use types. The several different approaches for landslide mapping can be grouped on (i) a single image taken after a landslide event or (ii) through the combined analysis of pre-event and post-event images (change detection approach). The various approaches can also be grouped on the type and size of the geographical elements used for landslide detection and mapping, either “pixel based” or “object oriented”. Furthermore, geomorphologists exploit images taken by Synthetic Aperture Radar (SAR) sensors primarily to measure surface deformations, and to construct time series of surface deformations, at single points

Concerning the field mapping one of the most valuable technology is the satellite-based GPS, which has revolutionized the way geomorphological fieldwork is conducted. GPS allows for the rapid location of features on the topographic surface with unprecedented simplicity, and with accuracy that often exceeds the needs for landslide mapping.

References

Guzzetti F, Mondini AS, Cardinali M, Fiorucci F, Santangelo M, Chan KT (2012) Landslide inventory maps: new tools for an old problem. *Earth Sci Rev* 112:42–66



BIOSKETCH

Dr. Ivan Marchesini Ph.D.: Ivan Marchesini got a PhD in Applied Geology at the University of Perugia (Italy).

He has a long background of geospatial analysis through Open Source GIS which he has exploited in different fields of applied research such as fluvial geomorphology, slope processes, environmental impact assessment and mines reclamation.

He also has experience on the management and publication of geospatial data according to the OGC standards. In particular he has developed and is managing the SDI of the IRPI research institute and he contributed to set up the infrastructure for the publication of some experimental WPS services.

Currently he is trying to provide his scientific contribute to (i) the development and maintenance of a National Early Warning System for the forecasting of rainfall induced landslides, (ii) the development and the application of a physical based model for the slope stability analysis at regional scale, (iii) the application of the geomorphometry concepts for the landslide susceptibility analysis and for the landslides detection and mapping, (iv) the collection, organization and use of historical information on damaging natural events for risk assessment and reduction, (v) the exploitation of GIS and Web-GIS technology for the analysis and dissemination of geomorphological information.

He has participated in some EU and National/International projects, including LANDSLIP, STRESS, SAFETY, DORIS, LAMPRE, VIGOR, GIIDA, SANF.

Abstract

GIS OPEN SOURCE - QGIS & GRASS GIS

Ivan Marchesini held 2 lectures in the context of Diplomazia2 and both of them were deeply focused on introducing the learners to the usage of Open Source GIS software and in particular on the knowledge of two relevant GIS: QGIS (www.qgis.org) and GRASS GIS (grass.osgeo.org). The lectures have been

largely based on (Casagrande et al. 2014) authored, among the others, the lecturer.

The first lesson (lasted four hours) was split in three main parts dealing with the concepts of Geospatial Data, Coordinates Reference Systems and an Introduction to the specific software.

Attendees were initially introduced to the world of the geospatial data and in particular to (i) the data models (vector and raster), (ii) the data formats, (iii) the web services for geospatial data (Web Map Service, Web Feature Service and Web Coverage Service, i.e. WMS, WFS, WCS), (iv) the DataBase Management System extensions for geospatial (e.g. PostGIS, Spatialite).

Successively the lesson was addressed to provide some fundamental notions about the Coordinate Reference Systems (CRS) since, for doing cartography and GIS in particular, a basic knowledge of the conventions adopted to define the location, on the earth surface, of the human and natural entities, is required, in order to avoid rough errors and large inaccuracies.

In the last part of the first lecture, the QGIS and GRASS GIS software have been compared trying to highlight for which types of applications it is more advisable to use one or the other. In particular the comparison was made analysing the performances of the two software in doing (i) mapping (i.e. digitalization of terrain features based on the mouse click), (ii) interactive analysis (data processing using dedicated user interfaces), (iii) Massive analysis (data processing in batch even using a huge amount of data), (iv) printing (preparation of effective layouts for producing posters and/or figures).

Finally, some examples of research papers, published by Ivan Marchesini and co-authors, developing and using Open Source GIS have been shown (Marchesini et al. 2013, Marchesini et al. 2014, Mergili et al. 2014a, Mergili et al. 2014b, Minelli et al. 2014, , Marchesini et al. 2015, Santangelo et al. 2015, Alvioli et al. 2016)

The second lecture (one hour) was more practical and attendees were able to execute some exercises using the virtual machine provided by OSGeo (<https://live.osgeo.org>). The practical lesson was focused on the application of geospatial algorithms aimed at deriving river networks and watershed based on a Digital Elevation Model (DEM).

References

Alvioli, M., Marchesini, I., Reichenbach, P., Rossi, M., Ardizzone, F., Fiorucci, F., & Guzzetti, F. (2016). Automatic delineation of geomorphological slope units with r. slopeunits v1.0 and their optimization for landslide susceptibility modeling. *Geoscientific Model Development*, 9(11), 3975.

Casagrande, L.; P.; Frigeri, A.; Furieri, A.; Marchesini, I.; Neteler, M. (2014). GIS Open Source: GRASS GIS, Quantum GIS e SpatiaLite. Palermo: Flaccovio: [Kindle edition]. English edition. <http://a.co/1NxIEPG>

Marchesini, I., Santangelo, M., Fiorucci, F., Cardinali, M., Rossi, M., & Guzzetti, F. (2013). A GIS method for obtaining geologic bedding attitude. In *Landslide Science and Practice* (pp. 243-247). Springer Berlin Heidelberg.

Marchesini, I., Ardizzone, F., Alvioli, M., Rossi, M., & Guzzetti, F. (2014). Non-susceptible landslide areas in Italy and in the Mediterranean region. *Natural Hazards and Earth System Sciences*, 14(8), 2215-2231.

Marchesini, I., Santangelo, M., Guzzetti, F., Cardinali, M., & Bucci, F. (2015). Assessing the influence of morpho-structural setting on landslide abundance. *Georisk: Assessment and Management of Risk for Engineered Systems and Geohazards*, 9(4), 261-271.

Mergili, M., Marchesini, I., Rossi, M., Guzzetti, F., & Fellin, W. (2014a). Spatially distributed three-dimensional slope stability modelling in a raster GIS. *Geomorphology*, 206, 178-195.

Mergili, M., Marchesini, I., Alvioli, M., Metz, M., Schneider-Muntau, B., Rossi, M., & Guzzetti, F. (2014b). A strategy for GIS-based 3-D slope stability modelling over large areas. *Geoscientific Model Development*, 7(6), 2969-2982.

Minelli, A., Marchesini, I., Taylor, F. E., De Rosa, P., Casagrande, L., & Cenci, M. (2014). An open source GIS tool to quantify the visual impact of wind turbines and photovoltaic panels. *Environmental Impact Assessment Review*, 49, 70-78.

Santangelo, M., Marchesini, I., Cardinali, M., Fiorucci, F., Rossi, M., Bucci, F., & Guzzetti, F. (2015). A method for the assessment of the influence of bedding on landslide abundance and types. *Landslides*, 12(2), 295-309.

CHRISTIAN MASSARI

CNR – IRPI, Lecturer



BIOSKETCH

Christian Massari, PhD, is permanent researcher at the Research Institute for the Geo-Hydrological Protection (IRPI) of the National Research Council (CNR) of Italy. He received his M.S. degree in Environmental Engineering and Ph.D. degree in Hydraulic Engineering, both with excellence, from the University of Perugia, Perugia, Italy, in 2008 and 2012, respectively. Thanks to a graduate research fellowship, he spent a year in the Department of Hydrology and Water Resources at the University of Arizona, Tucson, AZ in 2011. After returning to Italy, he was a postdoctoral research fellow in the hydrology and remote sensing group at IRPI, where he is a permanent researcher since January 2017. His research interests include data fusion and data assimilation of hydrological variables (e.g., soil moisture and rainfall), hydro-validation of satellite soil moisture and rainfall

	<p>observations, filtering of satellite soil moisture, flooding risk analysis, and flood frequency assessment.</p> <p>Christian Massari hobbies are rock climbing, mountain running and photography.</p>
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Abstract

Remote Sensing of precipitation. State of the art techniques and innovative methods

The quantification of precipitation on a global scale is critical for applications ranging from climate monitoring to water resource management. Conventional observations through surface gauge networks provide the most direct measure of precipitation, although these are very much limited to land areas, with very few in situ measurements over vast areas of Africa and Asia. Weather radars, although providing a spatial measure of precipitation, are limited in extent and number. Satellite observations offer an unrivalled vantage point to observe precipitation on a global basis. Since precipitation is spatially and temporally highly variable, satellites are able to provide temporal and spatial samples commensurate with many precipitation characteristics. In the lesson, I reviewed the basic principles behind the measurement of precipitation from space along with the different type of sensors, satellite missions for the measurement of precipitation, new techniques based on the estimation of precipitation from satellite soil moisture measurements and principal applications in the natural hazard mitigation.

In summary, the lesson provides an overall review of satellite precipitation estimation, providing an outline of conventional measurements, the basis of the satellite systems used in the observation of precipitation, and the generation, availability and validation of the derived precipitation products. Hence, it provides the student with all the notions that (s)he would need to deepen the knowledge of the subject on his/her own.

The lesson is particularly important for the project Diplomazia 2 since many of the students come from and will operate in developing countries where the amount and the quality of ground-based observations of precipitation are very scarce.

PAOLA REICHENBACH

CNR – IRPI, Lecturer



BIOSKETCH

Paola Reichenbach is a senior research scientist at IRPI-CNR (Istituto di Ricerca per la Protezione Idrogeologica, National Research Council). The main topics of her scientific activity are :

- landslide identification and mapping;
- methods for landslide susceptibility and hazard assessment, exploiting GIS technology and statistical tools;
- qualitative and quantitative methods for landslide risk evaluation;
- spatially distributed rock fall modelling for hazard assessment and risk evaluation.

Abstract

Methods and techniques of landslide susceptibility mapping

Landslide susceptibility provides an estimate of the landslide spatial occurrence based on local terrain conditions. Landslide susceptibility is the degree to which an area can be affected by future slope movements, i.e. an estimate of “where” landslides are likely to occur. Susceptibility does not consider the temporal probability of failure (i.e., when or how frequently landslides occur), nor the magnitude of the expected landslide (i.e., how large or destructive the failure will be). In mathematical language, landslide susceptibility is the probability of spatial occurrence of slope failures, given a set of geo-environmental conditions. Assuming future landslides will be caused by the same factors that caused failures in the past, the past distribution of landslides (obtained from an inventory) is used to predict future landslides.

Landslide susceptibility maps can be prepared where accurate landslide inventory maps and environmental information are available. Model prediction skill and validation performances should be evaluated for a reliable susceptibility zonation. Landslide susceptibility has been evaluated in many locations around the world since the early '80 using distinct modelling approaches, diverse combination of variables, and different partition of the territory (mapping units). Among the different methods, statistical models have been largely used to assess landslide susceptibility and several model types have been proposed in the literature. A recent literature review revealed

that authors not always present a complete and comprehensive assessment of the landslide susceptibility that includes model performance analysis, prediction skills evaluation and estimation of the errors and uncertainty.

If we consider the impact in terms of usefulness and efficacy of the susceptibility maps to the community, we can confirm that dissemination (i.e., discussion and diffusion within the scientific community with presentation at conferences or with publications) is already achieved in many countries. On the other hand, efforts and work should be done: i) for the distribution and application of the susceptibility zonation and maps to the environmental planning and management people and ii) for the communication to the non-specialist public.

MAURO ROSSI

CNR _ IRPI, Lecturer



BIOSKETCH

Mauro Rossi is a researcher of the Consiglio Nazionale delle Ricerche (CNR) doing his research at the Istituto di Ricerca per la Protezione Idrogeologica (IRPI) in Perugia. He has diversified research interests focused on mapping, modeling and forecasting of landslides, floods and erosion processes in different geo-environmental and anthropic contexts. Mauro Rossi has developed (i) new methodologies for statistical and deterministic analysis of the susceptibility and hazard posed by different geo-hydrological phenomena and for the estimation of their impacts, (ii) new approaches to the definition of rainfall thresholds for triggering Landslides, (iii) early warning systems, (iv) approaches to the design optimal models for estimating landslide susceptibility and for the assessment of social risk posed by landslides and floods. Recently, he has developed a software for the joint modeling of landslides and erosion processes in relation to different scenarios of geomorphological, climatic, vegetational and anthropic changes, in order to adequately characterize the hillslopes and the hydrological basins dynamics.

Abstract

Theory of hydro-morphology: Introduction to modellistic approaches

The theoretical lecture is focused on the modelling, a fundamental activity of the scientific method that include a variety of techniques/approaches/analyses for investigating phenomena with the main purpose of acquiring new knowledge, or correcting and integrating previous knowledge. In scientific language, the term “model” is applied to a wide class of assumptions and complex and articulated constructions, theoretical or represented materially, with an intuitive and creative origin, specific to a particular science but extendable to other fields. A model may represent entirely or partially the subject of a research that aims to organize data and knowledge, but also to experiment and then interpret, explain, generalize, compare and exemplify didactically. The lecture specifically focuses on modelling in the earth science literature. After a brief and general introduction to modelling, the lecture gives details on why models are used in earth science and on how different types of modelling approaches can be selected due to their advantages and drawbacks. Important modelling evaluation phases are introduced and discussed presenting methodological examples. Particular emphasis is posed on the evaluation of (i) the model performance, (ii) the model validation and (iii) the model uncertainty. A tentative but generalized list of the different modelling steps is provided, highlighting and discussing important issues, such as the choice of the appropriate spatial and temporal modelling scale and resolution, or the specific phases of the model implementation. Even if specific to the earth science field, the concepts and methodological framework given in the lecture can be widely applied to other scientific disciplines or modelling fields.

PAOLA SALVATI

CNR – IRPI, Lecturer



BIOSKETCH

Paola Salvati is a research scientist at the Italian CNR – IRPI. Salvati graduated in geology at the University of Perugia and joined CNR IRPI in 1999, where she obtained a permanent research position in 2012. The research interests include: (1) the selection and organization of chronicle, archival and bibliographical sources aimed at the identification and localization of natural disasters, (2) the determination of the geo-hydrological physical characteristics and of their social and economic aspects, (3) the evaluation of the

	landslide and flood societal and individual risk to the population at different scales, and (4) the maintenance of dedicated website and social media to publish information on geo-hydrological risks to the population.
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Abstract

HISTORICAL DATA ON GEOHYDROLOGICAL HAZARD AND THEIR APPLICATIONS

Landslides and floods are common in Italy, where they cause severe damage and kill or injure people every year.

Using an historical catalogue of landslide and flood events with human consequences, we assessed individual and societal risk levels in Italy at various scales, and we investigated their temporal and geographical variations for different geographical, climatic and administrative subdivisions. When referred to the population, risk analysis aims to estimate the probability of lives lost and to establish probabilistic levels of individual and societal risk (Fell and Hartford, 1997).

National estimates of individual and societal risk levels in Italy were first determined by Salvati et al., (2003) and revised by Guzzetti et al., (2005). Regional estimates of landslide risk in Italy were established by Salvati et al., (2010). Information on landslide and flood risk is also available at <http://polaris.irpi.cnr.it/>.

For Italy, comprehensive information on the human consequences of floods and landslides, including the dead, injured people, missing persons, evacuated and homeless people, is available from 68 AD to 2014. During this 1947-year period, 1,269 floods and 1,620 landslides have caused at least 53,606 fatalities and 4,782 injured people (Salvati et al., 2016, 2013, 2010). A temporal analysis of the historical catalogue reveals that the number and the severity of the reported harmful events have increased with time. The reduced number of events in the early part of the catalogue is the result of incompleteness, a known bias of non-instrumental catalogues of natural events.

To determine landslide and flood risk to the population we used the more recent and complete portion of the historical catalogue from 1861 to 2016 (<http://polaris.irpi.cnr.it/>). To study the individual risk we determined the landslide and flood mortality, measured by the number of fatalities (deaths and missing persons) per 100,000 people in a period of one year. Using the ISTAT (Italian National Institute of Statistics) annual population data, we calculated the yearly landslide and flood mortality rates for different geographical areas. Between 1861 and 2016 the average landslide mortality in Italy was 0.08 and the average flood mortality was 0.05 and between 1961 and 2016 the landslide mortality was 0.11 and the average flood mortality was 0.026. This means that

in the 50 years between 1961 and 2016, an average of 13 people every 10 million were killed by landslides and floods every year in Italy.

We found that mortality depends on the physiographic settings. In the recent period 1960-2010, landslide mortality increased in the mountains of Northern Italy and in the coastal mountains of Central Italy. In Southern Italy, mortality has decreased slightly in the mountains, and significantly in the coastal hills. The largest average flood mortality rate was recorded in the coastal hills. Flood mortality increased in the coastal mountains of Northern and Central Italy, and decreased in the hills of the North. In Southern Italy mortality decreased slightly in the plains and significantly in the coastal hills.

To determine societal landslide and flood risk levels, we established the probability of experiencing landslide and flood events with casualties (deaths, missing persons, and injured people), modelling the empirical distributions of events with a Zipf distribution (Newman, 2005). We modelled the casualty data in the 20 Italian regions. Trentino-Alto Adige and Campania exhibit the largest societal landslide risk, and the Emilia-Romagna has the lowest landslide societal risk. In the same period, societal flood risk was largest in Piedmont and Trentino Alto Adige in Northern Italy, and in Sicily and Campania in Southern Italy.

Despite the large number and wide geographical distribution of landslide and flood events, and the efforts exerted to analyze landslide and flood hazards and the associated risk, the Italian population receives minimal information and has minimal knowledge on the type, characteristics and severity of the harmful events that have occurred in the territory where they live. To address the problem posed by the lack of communication on geo-hydrological hazards in Italy to the broader society, we designed the POLARIS website (Salvati et al., 2016). The POLARIS website publishes accurate and detailed information on geo-hydrological risks, including periodical reports on landslide and flood risk to the population of Italy, data and analysis on specific damaging events and blog posts on landslide and flood events that able to encourage mass media and citizens' engagement.

In our opinion, the scientific community can play a key role to increase the awareness of individuals and groups on the type and extent of the risk posed by geo-hydrological hazards the population.

References

- Fell, R., and D. Hartford. 1997. *Landslide risk management*. Pages 51–109 in D. Cruden R. and Fell (eds.), *Landslide risk assessment*. Balkema, Rotterdam
- Guzzetti, F., Stark C.P., and Salvati, P.: *Evaluation of flood and landslide risk to the population of Italy*. *Environ. Manage.*, 36, 15-36, doi:10.1007/s00267-003-0257-1, 2005.
- Newman, M.E.J.: *Power laws, Pareto distributions and Zipf's law*. *Contemp. Phys.*, 46:5, 323-351, 2005.
- Salvati, P., Guzzetti, F., Reichenbach, P., Cardinali, M. and Stark, C. P.: *Map of landslides and floods with human consequences in Italy*. CNR Gruppo Nazionale per la Difesa dalle Catastrofi Idrogeologiche Publication n. 2822, scale 1:1,200,000, 2003.

Salvati, P., Bianchi, C., Rossi, M., and Guzzetti, F.: *Societal landslide and flood risk in Italy*. Nat. Hazards Earth Syst. Sci., 10, 465-483, doi:10.5194/nhess-10-465-2010, 2010.

Salvati, P., Bianchi, C., Rossi, M., and Guzzetti F.: *Flood Risk in Italy*. In: Changes of flood risk in Europe, edited by Kundzewicz, Z., IAHS Special Publication 10, IAHS Press, UK, 277-292, 2012, available at <http://www.iahs.info/bluebooks/SPO10.pdf>, 2012

Salvati P., Marchesini I., Balducci V., Bianchi C., Guzzetti F.: *A New Digital Catalogue of Harmful Landslides and Floods in Italy*. In *Landslide Science and Practice. Proceedings of the Second World Landslide Forum, Rome, 19-25 September 2011*, edited by Margottini C., Canuti P., Sassa K., Vol. 3: Spatial Analysis and Modelling, 409-414, ISBN: 978-3-642-31309-7, 2013.

Salvati P., Pernice U., Bianchi C., Fiorucci F., Marchesini I., Guzzetti F. (2016) *Communication strategies to address geohydrological risks: the POLARIS web initiative in Italy*. *Natural Hazards and Earth System Sciences* Vol. 16, 1487-1497, 2016. (<http://www.nat-hazards-earth-syst-sci.net/16/1487/2016/>) doi:10.5194/nhess-16-1487-2016

MICHELE SANTANGELO

CNR – IRPI, Lecturer



BIOSKETCH

I am a geologist working as a researcher at the Research Institute for Geo-hydrological Protection (IRPI) of the National Research Council. As a researcher, my activities are mainly, but not limited to, landslide and geomorphological mapping exploiting consolidated techniques and testing/developing new technologies. I am interested in defining standards for landslide mapping, and evaluating the uncertainty in landslide inventories, and how it propagates through the processing chain that leads to landslide risk assessment.

Abstract

LANDSLIDE MAPPING – CONVENTIONAL METHODS AND TOOLS

Landslide inventory maps (LIMs) show where landslides have occurred in an area, and provide information useful to different types of landslide studies, including susceptibility and hazard modelling and validation, risk assessment, erosion analyses, and to evaluate relationships between landslides and geological settings. Landslide mapping relies on the assumptions that landslides that occur over a territory leave clear and discernible signs. Such elements are referred to as a “landslide signature”, and can be mostly “photographic”, i.e. related to spectral characteristics (tone, texture, mottling, pattern), or “morphologic” i.e. related to morphologic characteristics (shape, curvatures, hummocky topography).

Landslide inventory maps are produced using conventional (consolidated) methods and new (innovative) techniques. Conventional methods used to prepare landslide maps include (i) geomorphological field mapping, and (ii) the visual interpretation of stereoscopic aerial photographs. Despite recent technological advancements, visual interpretation of stereoscopic aerial photographs (API) remains the most common method to prepare LIMs.

Recognition of landslides through the visual analysis of stereoscopic aerial photographs is an empirical and uncertain technique that requires experience, training, a systematic methodology, and well-defined interpretation criteria. Standards do not exist, and the interpreter detects and classifies landslide morphological forms based on experience, and on the analysis of a set of characteristics (a “signature”) that can be identified on the images.

Stereoscopic aerial photographs are exploited by trained geomorphologists to detect landslides, and to classify them inferring the type of failure, estimating the mobilised volume, the degree of activity and “freshness” of the landslide signature (i.e., estimating the relative age), and the landslide velocity.

Photo-interpretation is a logic process that can be divided in to four phases: (i) Photo-reading; (ii) Analysis; (iii) Classification; (iv) Deduction. Based on the experience of the interpreter, the photo-interpretation can stop at the photo-reading level or can reach the deduction level.

The scale of the aerial photographs, the type of stereoscope used, the land use, and the experience of the photo-interpreter, can influence the completeness of landslide inventory maps by aerial photo-interpretation.

CHIARA CAGNAZZO

CNR – ISAC, Tutor



BIOSKETCH

Chiara Cagnazzo is part of the DIVAC research group (DIVAC-Climate dynamics and variability: processes, reconstructions, scenarios and impacts) at ISAC. She actively participates in several national, European, international research programs and projects dealing with climate variability, climate change and impacts. She is a full-time staff researcher at ISAC-CNR since December 2011 and involved as professor teaching at the University of Rome “Tor Vergata” (course on Numerical Modelling, Physics Department). She has a Ph.D. in Atmospheric and Oceanic Sciences

	from Ecole Polytechnique in Paris. She has large experience in development of Earth System Models, management of large climate datasets and global scale model evaluation.
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Abstract

Climate projection uncertainties and implication for climate extremes and agricultural indices.

Climate change has a direct impact on several agricultural indices. The impact occurs through direct changes on the mean climate and on the climate variability and extreme weather events. In the project we used all available Global Climate Model simulations available within the CMIP5 Project, focusing on the historical (1850-2005) and the available RCP8.5 (2006-2100) simulations, as a starting point and we used ERA-Interim as a set of “observations” to compare with.

Why the mean climate: Higher growing season temperatures can significantly impact agricultural productivity, and even moderate levels of climate change may increase in the mean seasonal temperature bringing forward the harvest time of current varieties of many crops. This may have a large variety of impacts. For example, in areas where temperatures are already close to the physiological maxima for crops, such as seasonally arid and tropical regions, higher temperatures may be more immediately detrimental, increasing the heat stress on crops and water loss by evaporation.

Concerning climate variability and extremes, we focused on max and min surface temperature and precipitation extremes. While changes in long-term mean climate will have significance for global food production and may require ongoing adaptation, greater risks to food security may be posed by changes in year-to-year variability and extreme weather events. In our analysis we focused on: Extreme temperatures, droughts, heavy rainfall and flooding.

Climate Model data have been calibrated prior the estimation of indices such as the Growing Degree Day (GDD) index. This because climate projections suffer from mean biases and have to be treated before their use for estimating climate indicators that need absolute values of temperature and precipitation. An estimation of the uncertainty associated to the climate projection of those indicators is also largely dependent on the calibration methodology.

Our next step is to publish on a peer review journal the stage results. And, if our collaboration will last after the end of the project, to understand if using

high resolution global models is better than using regional models for the estimation of such climate indicators.

My personal evaluation of the stage is that Yassmin and Anis are self-motivated and easy to work with and really able to work in a team. They are talented, enthusiast, friendly and active researchers. Thanks to their attitude the Diplomazia2 stage at ISAC in Rome was a real success.

FRANCESCO CAIRO

CNR – ISAC, Lecturer



BIOSKETCH

He is a senior researcher at Institute of Atmospheric Sciences and Climate (ISAC) and contract professor of Atmospheric Physic at the University of Rome “Tor Vergata”. He has a long standing experience in the study of the atmosphere by optical techniques, with ground based and airborne/balloon- borne devices, with special emphasis on atmospheric aerosol and high altitude clouds. His hobbies are reading, playing music and practicing sports.

Abstract

The course delivered aimed to provide an introduction to the main processes that take place in the atmosphere, and focused on the dynamics and thermodynamics of the atmosphere, its composition and how it is altered by the main chemical-physical processes, the interaction of atmospheric components with UV and IR radiation, micro and macrometeorological phenomena. Thermodynamics deals with the transformations of the energy in a system and between the system and its environment. Hence, it is involved in every atmospheric process, from the large scale general circulation to the local transfer of radiative, sensible and latent heat between the surface and the atmosphere and the microphysical processes producing clouds and aerosol. Thus the topic is much too broad to find an exhaustive treatment within the limits of a few hours of lesson, whose main goal will has been limited to give a broad overview of the implications of thermodynamics in the atmospheric science and introduce some if its jargon. The basic thermodynamic principles have been reviewed, and emphasis has been placed on some topics that will find application to the interpretation of fundamental atmospheric processes. An overview of the composition of air has been given, together with an outline of its stratification in terms of temperature and water vapour profile. The ideal

gas law has been introduced, together with the concept of hydrostatic stability, temperature lapse rate, scale height, and hydrostatic equation. The concept of an air parcel and its enthalpy and free energy has been defined, together with the potential temperature concept that will be related to the static stability of the atmosphere and connected to the Brunt-Vaisala frequency.

Water phase changes play a pivotal role in the atmosphere and special attention has been posed on these transformations. The concept of vapour pressure has been briefly introduced together with the Clausius-Clapeyron equation and moisture parameters have been defined. Adiabatic transformation for the unsaturated and saturated case have been discussed and the notion of neutral buoyancy and free convection has been introduced. A brief overview of warm and cold clouds formation processes, with the aim to stimulate the interest of reader toward more specialized texts.

PAOLO CRISTOFANELLI

CNR – ISAC, Lecturer



BIOSKETCH

Paolo Cristofanelli is scientist at the Institute of Atmospheric Sciences and Climate (ISAC) of the Italian National Research Council of Research (CNR) and head of the Climate Observatory “O. Vittori” at Mt. Cimone (2165 m a.s.l., Italy), one of the 31 global stations belonging to the Global Atmosphere Watch (GAW) programme by WMO. He is involved on research about detection and attribution of atmospheric composition variability (trace gases and aerosol) with a special emphasis on climate-altering and pollutant compounds (i.e. SLCF/P and well mixed greenhouse gases). Paolo Cristofanelli has more than 10 year experience in educational and outreach activities by project related to primary and secondary schools, popularization events, seminars, public events and scientific outreach by web. He is authors or co-authors in more than 55 peer-reviewed papers. He enjoys outdoor activities (running and trekking), and good food.

Abstract

Chemistry in the Mediterranean region.

Southern Europe and Mediterranean basin are recognized as hotspot regions both in terms of climate change and air quality. Meteorological conditions characterized by frequent clear sky and high solar radiation favor the occurrence of ozone (O₃) photochemical production also thanks to the availability of natural and anthropogenic precursors. In particular, large amounts of anthropogenic pollutants emitted in continental Europe are transported towards the Mediterranean free troposphere and boundary layer. Saharan dust outbreaks from northern Africa) and open biomass burning further exacerbate air quality and the influence of anthropogenic emissions on the regional climate. Water scarcity, the concentration of economic activities in coastal areas, reliance on climate-sensitive agriculture together with demographic, social, cultural, economic and environmental changes are other critical factors which make this region particularly exposed to climate change and air quality worsening.

For these reasons, it is important to have long-term observations of essential climate variables with well assessed quality. In particular, in-situ or ground-based observations at mountain sites can provide key information about background atmospheric composition. They also provide the opportunity to investigate and assess the impact of natural and anthropogenic-related processes to atmospheric variable and then to regional climate and air quality. The lecture presented an introduction to key trace gases (both well-mixed and reactive, greenhouse gases and oxidants) in terms of sources (natural and anthropogenic), removal and transport processes, typical levels and variability (on different time scales) and their role in the climate system of in the Mediterranean basis troposphere. To provide the most updated information, different data synthesis from GAW/WMO reports was presented. We also provided a description of the most used detection measurements for the investigation of trace gases by in-situ or remote sensing measurements (CLD, CRDS, Off Axis -ICOS, DOAS, MAXDOAS). We introduced and described international research networks, i.e. WMO/GAW, NDACC, ACTRIS, ICOS.

SILVIO DAVOLIO

CNR – ISAC, Lecturer



BIOSKETCH

Silvio Davolio is research scientist at CNR ISAC. Main research interests: atmospheric dynamics, data assimilation, and numerical meteorological modelling, in particular application of numerical models to the study of intense meteorological phenomena in the Mediterranean associated with the presence of complex orography. I like meteorology and I like mountains.

Abstract

Numerical meteorological models and numerical weather predictions.

The interest in numerical weather predictions (NWP) has increased since the beginning of XX Century and its progressive development has been strictly related with availability of more powerful computers. In the 1920s, Lewis F. Richardson was the first to produce a weather forecast, applying the ideas proposed by Vilhelm Bjerknes some years before. It took some days to produce by hand a completely wrong short-range forecast, but this is considered the beginning of NWP, since a scientific method was established. Later on, the advent of the computer and the contribution of great scientists (such as Rossby, Charney, Lorenz, Phillips among others) developed this “new” science.

A NWP model integrates the equation of atmospheric physics, starting from an initial condition, to predict the state of the atmosphere in the future. Usually it operates on a discrete grid, and the distance between grid points defines the resolution of the model. All the processes that act at scales shorter than grid-space are called sub-grid processes and cannot be described explicitly by model equations. They are represented through physical parameterization schemes. Given the constraint imposed by computational resources, the model resolution cannot be increased as desired. Regional (limited area) models that operate on a specific area instead of over the globe, allows to attain higher resolution and thus to resolve explicitly smaller-scale meteorological phenomena that cannot be represented on the coarser grid of a global model.

Although NWP models try to describe accurately all the dynamical and physical processes of the atmosphere, errors can arise from approximations in the parameterization schemes or from numerical computation, or even from the lack of understanding of some of those processes. Moreover, uncertainties in the initial condition are unavoidable, although complex systems of data assimilation have been developing. All the errors grow during the forecast, as a consequence of the chaotic behaviour of the dynamical system (atmosphere). Therefore, the forecast skill is limited, although improving year after year. Ensemble probabilistic forecasting is a way to cope with uncertainties and error growth.

NWP models are very important since they are the only tool that provides weather forecasting. This is a critical aspect for civil protection and for prediction of severe weather. NWP models can provide the input for hydrological or oceanographic forecasting systems and this kind of forecasting chains are nowadays routinely applied at several environmental agencies. Not only: NWP models are also an extraordinary scientific tool in dynamic meteorology to perform research activities.

This overview of NWP models and their applications will allow the students to use meteorological models in their future research activity, not simply as “black box”, but being aware of their operation, applicability, limits and errors.

ANGELA MARINONI

CNR – ISAC, Lecturer



BIOSKETCH

Angela Marinoni has degree and PhD in Environmental Sciences, with experience on chemistry and photochemistry of aerosol, cloud and precipitations in different environments. After a PhD on aerosol-cloud interaction at Clermont-Ferrand University (Physical Meteorology Laboratory) and a Post-Doc at Bologna University (Chemistry Department), she is working since 2005 at CNR-ISAC, where she gained experience on integration of observations concerning chemical, physical and optical aerosol properties, especially in mountain and remote areas. She also performs several scientific dissemination and educational activities with workshops, seminars and guided tours for different audiences on atmospheric pollution, impact on climate, environment and human health. Her main hobby is to spend time in wild nature, especially in mountain environments.

Abstract

The course delivered aimed to provide a brief introduction to the main processes affecting aerosol properties in the atmosphere. The processes of emission and particles formation have been showed for the primary and secondary particles, as well as the physico-chemical evolution in the atmosphere. Transport and transformation, as well as deposition mechanisms affect the global aerosol cycle. The main properties affecting climate and health are: size distribution, chemical composition, optical properties, as well as their great variability in space (lat. long.) and time (seasonality, diurnal cycle) strictly linked with different residence time. Typical characteristics (concentration, chemical composition, number/surface/mass size distribution) in different environments have been discussed.

The effect on climate through direct and indirect effects is depending from the optical aerosol properties that influence the radiative forcing and radiation budget.

The main techniques for measuring the aerosol properties relevant to Climate has been discusses in details: number and size (SMPS/OPC), chemical composition (off line and on line techniques), Vertical Distribution (LiDAR), Scattering and back-scattering coefficients (Nephelometers), Absorption coefficient (Absorption spectrometers, filter based and CAPS/Photoacoustic spectrometer), Aerosol Optical Depth (SunPhotometers) , RH-dependency (Cloud Condensation nucleus counter (CCN)).

GIULIA PANEGROSSI

CNR – ISAC, Lecturer



BIOSKETCH

Earned a Laurea degree in Physics at Sapienza University of Rome, and a Ph.D. degree at the Department of Atmospheric and Oceanic Sciences, University of Wisconsin-Madison, WI. She is Researcher at the ISAC-CNR since 2011. For over 20 years she has been involved in research focused on remote sensing of clouds and precipitation, development of passive microwave precipitation retrieval algorithms, radiative transfer through precipitating clouds. Her research interests include also cloud microphysics and cloud electrification. Member of the Precipitation Measurement Mission (PMM) Science Team, she coordinates scientific activity aimed at the delivery of operational precipitation products from space-borne passive microwave radiometers within national and international programs (i.e., EUMETSAT H-SAF). She enjoys outdoor activities, music, and art, and spending her free time with family and friends.

Abstract

Remote Sensing of Precipitation from Space.

The course offered an overview of the state-of-the-art of remote sensing techniques for precipitation retrieval exploiting Low Earth Orbit (LEO) microwave (MW) and/or geostationary (GEO) visible/infrared (VIS/IR)

observations, analyzing their potentials and limitations, and perspectives in view of future satellite missions. The course was divided in three parts: the first part focused on basic principles on the interaction between the cloud constituents (frozen and liquid hydrometeors) and radiation (in the MW and in the VIS/IR), and on the description of the main spaceborne observing systems with focus on passive MW sensors on board LEO satellites. It has been shown how in the MW spectrum the signal reaching the radiometer originates from different parts within the cloud, and how the signal can be related to surface precipitation considering a number of different factors: the channel frequency and spatial resolution, the radiometer's viewing geometry, cloud macro-and microphysical structure, and environmental conditions. Particular emphasis has been given to the NASA/JAXA Global Precipitation Measurement (GPM) mission, and to its Core Observatory launched on February 27, 2014, equipped with the most advanced spaceborne microwave imager (the GMI) and the first spaceborne dual-frequency (Ku and Ka-band) precipitation radar, providing semi-global (between 65°S and 65°N) 3-D view and retrieval of the precipitation (solid and liquid). The second part has focuses on the main precipitation retrieval techniques and in particular on the algorithms developed at CNR-ISAC in the context of the GPM mission within the EUMETSAT Hydrology Satellite Application Facility (H-SAF). An overview of the main precipitation products made available by international agencies and organizations, both for climatological studies and for near-real time (NRT) applications has been provided. Finally, the third part of the course was dedicated to show examples on the use of satellite-based precipitation products in extreme precipitation monitoring, analysis of precipitation structure, and in climatological applications. It was shown how spaceborne MW observations are best suited for quantitative precipitation estimates from space, offering a 1-3 hour global coverage after the advent of the GPM. On the other hand, combined LEO MW/GEO IR techniques, benefiting from the physical robustness of MW retrieval techniques and from the high spatial and temporal resolution of GEO observations, provide an effective tool to monitor the evolution of precipitation from space and for NRT applications.

Chapter 4

Course 2

Management and Use of agro-food resources with the aim of fostering sustainable agriculture and arboriculture as well as of reducing the physical and biological effects of climate changes

Domenico Pignone*, Ahmed Abdallah, Aissa Arous, Gordana Durovic, Rasha Eid, Ines Ellouze, Marsela Luarasi, Moustafa Moataz, Sabrine Nahdi, Abdel Gawad Saad, Lama Soueidan, Reda Tabikha, Maurizio Bacci¹, Marina Baldi¹, Giulio Betti¹, Tiziana De Filippis¹, Roberto Ferrise¹, Edoardo Fiorillo¹, Beniamino Gioli¹, Ramona Magno¹, Alessandro Matese¹, Massimiliano Pasqui¹, Federica Rossi¹, Vieri Tarchiani¹, Piero Toscano¹, Fabrizio Ungaro¹, Francesco Vaccari¹, Roberto Vallorani¹, Patrizio Vignaroli¹, Emanuele Zucchini¹, Sergio Molinari², Pasquale Saldarelli², Vincenzo Lippolis³, Annalisa De Girolamo³, Miriam Haidukowski³, Veronica MT Lattanzio³, Michelangelo Pascale³, Carla Benelli⁴, Anna De Carlo⁴, Cristiana Giordano⁴, Alessio Giovannelli⁴, Maurizio Lambardi⁴, Raffaella Petruccelli⁴, Maria Gallitelli⁵, Rina Innacone⁵, Angelo Petrozza⁵

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1. CNR – IBIMET, <http://www.ibimet.cnr.it>

2. CNR – IPSP, <http://www.ipsp.cnr.it>

3. CNR – ISPA, <http://www.ispacnr.it>

4. CNR – IVALSA, <http://www.ivalsa.cnr.it>

5. ALASIA – Agenzia Lucana di Sviluppo e di Innovazione in Agricoltura, <http://www.alsia.it>

Along the coasts of the Mediterranean sea some 150 million people live and their number roughly duplicates during summers. It is evident that all these people rely on a food production that is mostly concentrated along the coastal areas, especially for what the southern Mediterranean is concerned.

All Mediterranean countries have very similar food traditions and the whole “Mediterranean diet” is based on the same crops, with wheat, barley, chickpeas, lentils and broad bean being the staple grains of the traditional diets that used olive oil as condiment. This common feature has also led to describe the Mediterranean cultural/food tradition as the “olive civilization”.

Unfortunately, the climate change is striking hard on the Mediterranean area, and this occurrence is endangering at its basis the “olive civilization”. Most evident effects of climate change are the change on the distribution of precipitations. We face longer dry periods and shorter rainy ones, even though the total amount of meteorological water is roughly the same, with a double impact on crops, for the increased aridity, and on the environment, due to the erosion of the extreme events.

Less evident are the biological effects of the global change. The rise of average temperatures affects the life cycle of insects, some of which, have a shorter reproduction period, thus the possibility of an extra generation per year. But even more striking is the effect of the high winter temperatures that do not slow eggs disclosure and larvae development, which is particularly important for parasite insects or insects that are vectors of microbial diseases. In addition, since different species are affected at different extents, the relative abundance of different species is disturbed and this is most evident when different species are in competition or one parasite with the other.

The increased movements of people and goods through the Mediterranean, together with the change in local meteo-climatic conditions, is increasing the possibility of spreading pests and parasites in areas where they were unknown and where they have no natural competitors. The palm tree weevil is the example, evident also to people with no specific knowledge.

For all the above reasons it is essential to increase the knowledge on how to measure the climate change, how to describe its impact on plants, on environment relationships and on how to rely on plant genetic resources to face the challenge imposed by global change.

4.1 Course 2 Coordinator, Objectives and Results

DOMENICO PIGNONE

Coordinator Course 2



BIOSKETCH

CNR Research Director

Has been director of two CNR institutes and a CNR Department

Expert of Plant genetics, Plant phenomics, Plant genetic resources, Crop evolution

Expert of seed gene bank management and CNR coordinator of a technical assistance program to the Tunisian Gene Bank (Banque des Genes Tunis)

Has long lasting experience in scientific project coordination and management

Has published over 160 paper in scientific journals and 15 Books or book chapters

Course Objectives

Following the above reasoning, the course focuses on the achievement of three major goals:

- Improve knowledge on agro-meteorology tools for measuring the physical impact of climate change and develop tools for predicting climate and extreme events;
- Improve the study of new and emerging pests and parasites and develop methods for their control or for mitigating their impact on crop production;
- Improve the knowledge of the impact of microbial populations on the quality of food production.

These goals were achieved through theoretical and practical activity on some major topics

- 1- Sources of climate data and information
- 2- Soil ecosystem services at different scales: methodological approach at multiple governance levels

- 3- Preservation of plant biodiversity: general concepts and biotechnological applications
- 4- Plant Biotechnology: In Vitro Propagation and Conservation.
- 5- Methodology for Mycotoxin detection
- 6- Control of plant pathogens
- 7- Agro-biodiversity Phenotypic and Genotypic analysis

Results

The students were hosted at four different Institutes of CNR:

- IBIMET: theoretical and practical training of meteorological and climate analysis, agronomical practices to mitigate effects of climate change, economic impact;
- IVALSA: general concepts on plant biodiversity conservation and management, biotechnological tools for plant conservation and propagation, physiology of plant growth and adaptation;
- IPSP: general concepts of plant pathology, plant-pathogen interaction, detection and measurement of plant pathogens, application of Next Generation Sequencing for detecting and identifying viruses and bacteria
- ISPA: microorganisms and human health, toxigenic fungi, classical methods for characterization of mycotoxins, fast mycotoxin detection methods, managing collections of toxigenic fungi.

All students have received a general formation on the subjects described in the objectives. Each student has been followed by a tutor and specialized at specific institutes on the specific arguments that are part of the specialization of that institute.

Details on each student course and knowledge are present in the students reports.

4.2 Course 2 Fellows

AHMED M. ABDALLAH

Egypt



BIOSKETCH

Assistant professor; Natural Resources and Agricultural Engineering department, College of Agriculture, Damanhour University. Damanhour, EGYPT. I am also, a trainer within the ministry of water resource and irrigation of Egypt.

My duties and responsibilities as an assistant professor include, teaching, research, training, conducting lab and field works, co-supervise undergraduate students, and co-operating with my other colleagues. I teach the undergraduate students several courses, (e.g., soil physics, irrigation system design and plant, soil, water interrelations). I am interested in working towards environmental resources conservation, I am interested in optimizing water use efficiency especially under water deficit conditions as the climate change is proposing huge challenges. I am also interested in the mitigation of environmental pollution by agro-chemicals.

My favorite hobbies are playing football, watching football games, reading, listening to music, while listening to music I can get everything off my chest.

I have applied for Diplomazia2 for the following reasons:

The most important reason that had encouraged me to apply is that this training is organized by the National Research Council of Italy (CNR). I learned about Diplomazia2 from my friends who participated in Diplomazia1. Since Diplomazia2 is an international training course, participating in such course would make me acquire new knowledge, enlarge my professional experience and enhance my skills. Indeed, I expected that this training will give me the opportunity to gain new practical approaches, international collaboration, exchange of knowledge and skills with other colleagues and to study and conduct research, and, above all, the specific course I applied for, is highly related to the sustainable resources management under climate change to insure food security, and Egypt, as well as many other countries, is facing food

security problems, thus, learning new approaches and techniques, may help my country to better deal with these problems. Finally, such training course may provide chance to open a collaboration between my college and different CNR institutes in Italy.

My experience as Diplomazia2 Fellow:

The training we had, was divided into two different parts: a theoretical part, and a practical one. We followed very well organized lectures for 7 weeks. During these 7 weeks, we acquired a lot of information related to climate change factors, impacts of climate change, water resources management, crop modeling, food security, and sustainable agriculture under climate change conditions.

In parallel to the theoretical part, I had the practical one. In the practical part a lot of laboratory and field work was done to study the impacts of wool wastes application on soil physical and chemical properties and plant growth.

Under climate change conditions, the rain distribution is going to be very poor throughout the rainy seasons. Thus, the precipitation will be intensive, heavy and less frequent. So, within rain fed agriculture recently and in the future, plants will be subjected to intensive and heavy rain events, while other time, plants will be subjected to drought. In times of heavy and intensive rains, there is a high potential for runoff and soil erosion in addition to the inefficient use of rain water. While drought can cause yield losses. Not all the rain a particular area receives, is an effective rainfall (available for plants) where, the effective rainfall is the total rainfall, minus runoff, minus evaporation and minus deep percolation; only the water retained in the root's zone can be used by the plants.

Using soil amendments to increase soil organic carbon, increase soil water holding capacity to enhance soil physical and chemical properties, is critical under climate change conditions in order to sustain water and land productivity. Indeed, sheep wool is a by-product worth noting, perceived as waste which is either dumped, burned, or sent to landfill or illegally thrown over. Moreover, the annual EU coarse wool clip amounts to more than 200 thousands tons (18-20 thousand tons are produced in Italy) and its management is a problem.

Sheep wool residuals are materials that absorbs and retain moisture very effectively; this property can be a benefit when applied to soils where it can reduce runoff and soil erosion, and can aid in water conservation. On the other hand, wool residuals are light materials, which could reduce the soil density, thus increasing soil permeability and hydraulic conductivity of soil. To identify how the wool residuals will behave in the soil, ***a series of Lab and***

containers experiments were conducted: where two types of wool residuals were used; wool treated with acid (acidified Black wool residuals) and washed wool residuals (white wool residuals). The two types were mixed with soil in a rate of 0.5, 1 and 2%. Then the following tests were elaborated.

1. Water holding capacity (WHC).
2. Soil bulk density and soil porosity.
3. Water retention curve.
4. Irrigation water balance.
5. Rain water balance
6. Saturated hydraulic conductivity (K sat).
7. Soil salinity and ph over time
8. Slaking and Aggregate stability tests

Water holding capacity (Volumetric water content at Field capacity): Different concentrations (0.5, 1 and 2%) of both black and white wool with three replicates were mixed with the soil in a 1.5 L volume pots were filed with 1500 g of air dried soil. Enough water was allowed to be absorbed by the soil in each pot through the bottom of the pot from a saucer filled with water. When the soil gets saturated, the saucers were removed and the pots were covered by parafilm to prevent evaporation, then pots were allowed to drain the excess of water for 48 hr. Then pots were weighted, thus gravimetric water content at field capacity was calculated. Volumetric water content was calculated by multiplying the gravimetric water content by soil bulk density. The results of this test showed a significant increase in WHC of soil treated with wool, especially the black wool at the highest concentration, where WHC was increased from 34.95% of control to 45.88% in case of the black wool at 2%.

Soil bulk density: soil bulk density was measured by the core method, the results showed a significant reduction in soil bulk density in favor of wool application. The lowest bulk density was recorded for both wool types at the highest concentration, where bulk density was reduced from 1.55 g cm⁻¹ in case of control to 1.29 and 1.28 g cm⁻¹ for the white and black wool residuals respectively.

Soil porosity: The results indicated soil porosity was significantly increased when wool residuals were added to the soil, the highest porosity was recorded at the highest concentration of both wool residuals.

Water retention curve: The soil treated with different wool residuals at different concentration (0, 0.5.1 and 2%) were saturated overnight, then it was subjected to a suction ranging from 0 bar to 15 bars (0, 0.3, 1, 3, 5 and 15 bars) in the laboratory using a pressure plate. The results indicated a

significant increase in soil water holding capacity and in plant available water as compared to the untreated soil, particularly the black wool at the high concentration (2%).

Irrigation water balance using drip irrigation: Same concentrations (0, 0.5, 1 and 2%) of both black and white wool residuals were mixed with the soil 1.5 L pots. Pots were irrigated using a drip irrigation system using emitters of a flow rate of 2 L/h, affixed water volume of 350 cm³ were applied (enough water to reach field capacity). Pots were covered by para film to prevent evaporation, then pots were allowed to drain the excess water for 48 hr. pots were weighted, thus gravimetric and volumetric water content at field capacity was calculated. The results of this test indicated no significant differences in soil water content when the water was applied to the soil through the soil surface, indicating that wool residuals absorb a significant amount of water if it had enough time to absorb the water (saturating the soil with water from bottom) which was not the case of this test.

Rain water balance experiment: To study the effect of different wool residuals types and concentration on soil water holding capacity, deep percolation and runoff under natural rain conditions (rain water balance), soil was mixed with two different wool types (black and white wool), with three concentration each (0, 1% and 2%) with three replicates. pots of 30 L volume with an approximate 32 cm diameter and 30 cm depth were filed with 35 Kg soil. Containers were fixed at the bottom of the pots to collect the percolated water, also contains were fixed at soil surface using detached tube to collect the runoff. Pots were left under natural rain conditions for three rain events. After each rain event, pots were weighted, leachate and runoff was collected and its volume was measured.

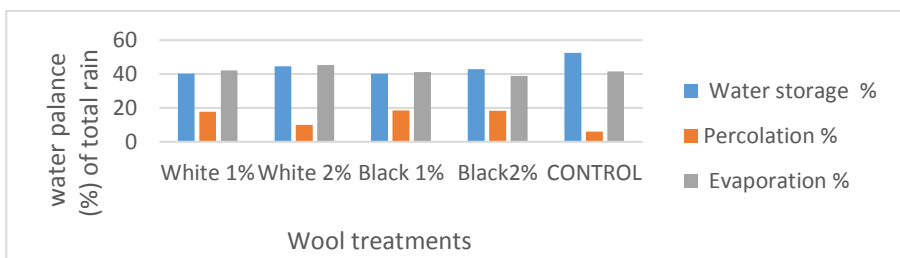


Figure 4.1: Rain water balance after three rain events (soil water storage, percolation and evaporation) as a percentage of total precipitation

The results of this test indicated that water storage in controlled soil was higher than the wool treated soil. While, the black wool treated soil had the lowest water storage and the higher percolation. The presence of both wool residuals increased the deep percolation as compared to the control. Increasing the wool concentration from 1% to 2% reduced the amount of water storage and

enhanced water infiltration, resulting in a significant increase in the water percolation. The reduction in water storage could be attributed to the increase in saturated hydraulic conductivity, as the results of saturated hydraulic conductivity showed an increase, when both wool types were applied especially the black wool. The presence of wool enhanced water percolation rather than water holding capacity, despite of the high absorbing capacity of the wool, its effect in water movement was higher than water absorption. The overall average of water stored was higher in the control soil, followed by the white wool, then the black wool.

Soil salinity and Ph over time: soil salinity and soil ph were measured at three different time after mixing the wool residuals with the soil. The results indicated that wool application significantly increase salt concentration in the soil particularly the white wool. Indeed the application of the black wool residuals reduced the Ph significantly once it was applied to the soil.

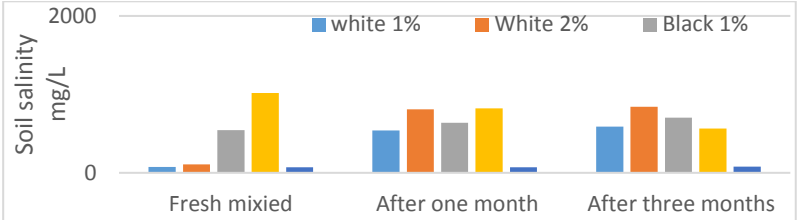


Figure 4.2: Effect of different wool types (white and black wool) with different concentrations (0, 1 and 2%) on soil salinity (mg L-1) after different times of wool treatment

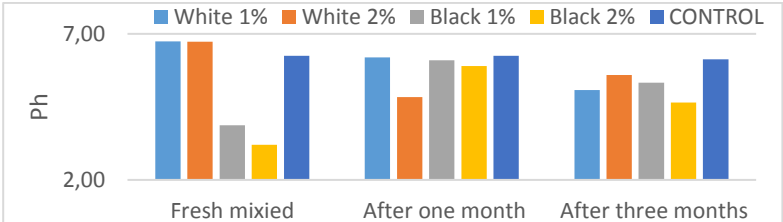


Figure 4.3: Effect of different wool types (white and black wool) with different concentrations (0, 1 and 2%) on soil Ph after different times of wool treatment

Slake test and aggregate stability test: the results of both tests showed that wool application significantly increased the stability of soil aggregates. This could be attributed to the increase of both salt concentration and organic matter. The soil treated with the white wool showed to be more stable than the black wool and the control as well. Increasing wool concentration increased the stability of the aggregates.

Conclusion: The application of sheep wool residuals to sandy loam soil significantly changed its hydraulic properties. Despite the analysis of both water holding capacity and the water retention curve, indicated that wool may increase soil water holding capacity, the results of rain water balance showed the opposite where, water percolation was increased compared to the control treatment. The increase in water percolation is in accordance with the increased saturated hydraulic conductivity. Also wool residuals application increased aggregate stability and soil porosity. It seems that wool as a light material reduced soil density and increase its permeability, thus less water storage was recorded. Wool residuals application could be used to reduce surface runoff and soil erosion under heavy and intensive rainfall not for increasing water storage in soil.

How diplomazia2 can improve my future perspectives

Diplomazia2 improved my knowledge and I have gained new skills, also, I was able to exchange knowledge and skills with other colleagues at IBIMET-Firenze. Moreover, I had the opportunity to carry out a research employable in the field of soil management for climate change adaptation. That is why I am sure that the knowledge and results I got and the skills I have learnt are going to improve my career and open a new field of research. Also, I am going to convey all that I have learnt to my students and colleagues in my college. Moreover, one of the most important consequence of this training is the relations that I had built with professors and colleagues at IBIMET-FI. Such training course may provide a chance to open a collaboration between my college and different CNR institutes in Italy. In this way,



Figure 4.4: Training Activity

my research career will be improved by acquiring new scientific knowledge and increasing my international collaborations and publications, which I am sure will be valuable for me and my department in my home country.

REDA MOHAMMED MANSOUR TABIKHA

Egypt



BIOSKETCH

I was born 4/5/1975 in East District – Alexandria Governorate, Egypt. I live in Egypt, El-Behera Governorate, Rashid, 14 Galal El-Dassoki St. My office is Department of Plant Protection, Faculty of Agriculture, Damanhour University, Egypt.

My degrees:

B. Sc.; Agric. Sc. (Chemistry and Toxicity of Pesticide, 1997); Faculty of Agriculture, Alexandria University.

M. Sc.; Agric. Sc. (Economic Entomology, 2002); Faculty of Agriculture, Alexandria University.

Ph.D.; Agric. Sc. (Economic Entomology, 2008); Faculty of Agriculture, Alexandria University.

Current Employment Position:- Associated Professor of Insects Ecology and Taxonomy, Plant Protection Department, Faculty of Agriculture, Damanhour University.

Computer Programming, Electronics, Reading and Watching movies.

Diving, Motor boating and Walking.

Why I have applied for Diplomazia2 and expectations

For me, as entomologist, it is important to know future of insect pests populations trends (hosts, populations density, impacts of climatic factors, natural enemies, outbreaks times, rearing times, consumption rates, economic injury level, *ect.*) under predicated conditions of climatic changes and its extended effect on food resource and Agro-ecosystems, so the course 2 entitled “Management and use of food resources aimed at the sustainability of agriculture and forestry and at the mitigation of the effects of climate change” was very attractive to me together with learning that new theoretical and practical knowledge could be gained during the training program. On the other hand, presence of colleagues in faculty of Agriculture, Damanhour University as participants in Diplomazia1 program (2014) was also another synergic factor that encouraged me to attend and apply to Diplomazia2.

My expectations and attractive points were the possibility of participants to have the opportunity to be trained in laboratory activities, working side by side with CNR staff in areas of my interest and that program organizers may help me choose which training path was more suitable for me. So my professional/academic background, as well as personal scientific interests,

could be achieved during this training program. So I hoped for a limited amount of traditional lectures and more space for training in specific laboratories and side by side working with researchers within labs. So, my main hope may be achieved by deepening advanced biological and ecological studies with CNR staff on meadow spittlebug, *Philaenus spumarius*, the main vectors of *Xylella fastidiosa* bacteria in olive orchards that causes Olive Quick Decline Syndrome (OQDS) in Italy.

My Experience as Diplomazia2

Training Program Parts

- i. Reception meeting:-** IBIMET held a reception meeting at the beginning of the training course to show activities and research interests of IBIMET and introduce us to IBIMET staff.
- ii. Training plan meeting:** IBIMET organized a meeting to show available facilities to conduct research or in Lab training.
- iii. Seminar circle:** On March 8th 2017, IBIMET held a seminar under title (**Insect Populations and Climatic Changes**) at 14:00 pm in the 1st Classroom of the Research Area of Sesto Fiorentino to show my scientific and research interests.
- iv. General Theoretical Courses :** The second part of this training program started with general theoretical courses which covered different aspects of scientific approaches such as (Climate Changes, Sources of climate data and information, Climate Smart Agriculture, Meteorological satellite data, Agriculture in the Mediterranean , Soil ecosystem services at different scales, Crops modelling, Drought monitoring and forecasting, Preservation of plant biodiversity, Economy, wood formation, Biochar as soil amendment, geoprocessing tools, Plant Biotechnology, Micotoxins, greenhouse gas exchange measurements, plant pathology, Fungal pathogens, Pest control, stomatal control and biochemistry of photosynthesis).
- v. Horizon2020 Training:-** DIPLOMAzia2 program announced and invited us to attend Horizon 2020 Training Days on European Institutions and European research programs strategies, 6-7 June 2017, which was held at CNR headquarters in Rome.
- vi. Special GIS Course:** IBIMET organized a special short course in Geographical Information Systems (GIS) and Remote Sensing (RS) for 10 weeks of study, 2 hours/week (Trainer: Dr. Edoardo Fiorillo)
- vii. Case Study for Research Purpose (GIS Course):** - Research issue has been conducted during a short course of GIS under the title of **“Climatic Changes and Expected Biological Aspects of Tomato Leaf Miner, *Tuta absoluta* (Meyrick), in Mediterranean Basin Countries by using Remote Sensing**

and Geographical information Systems (GIS)." The main purpose of this research is the estimation of development rate for different stages of *T. absoluta*, pre-oviposition, oviposition periods, lifetime fecundity and fertility, as well as longevity of adults spatially depending on effect of current temperature and impact of climatic changes on those values in Mediterranean Basin Countries. In addition, to employ the obtained information in integrated pest management programs.

My Experience During Diplomazia2:

- **Gained Experience from Training Courses:-** How climate change affects all the elements of the water cycle and its impact on agriculture. The Mediterranean region will be heavily impacted by climate change during the 21st century. Extreme events in Egypt impact on crop production, types of crop modelling and how to design crop model and forecast drought, Seasonal forecast in the Mediterranean Basin, Geoprocessing tools and meteorological satellite data, plants propagation in vitro as means to plant biodiversity preservation
- **Gained Experience from Horizon 2020 Training Days:-** getting useful information about EU Institutions and Policies, EU Framework Programme for Research and Innovation (pillars and funding opportunities), ERC grants and Marie Skłodowska-Curie Fellowships, European research programs strategies, and how to participate and submit proposal.
- **Gained Experience from GIS Course:-** how to employ QGIS and ArcGIS programs in plant protection and studying impact of climatic changes on insects populations, good information about main sources of free available satellite images, importance of detecting NDVI, moreover how to classify images by different techniques, finally possibility of GIS model building for pest predication.
- **General Gained Experience:-** the main experience that I gained, was meeting with different people from different cultures and exchange the knowledge and concepts with them. Moreover, I became aware of the problems that agriculture in Mediterranean Basin Countries will encounter and how to find effective means to solve it.

My Experience in Italy

Although my tour in Italy covered a wide range of subjects (scientific and exploratory trips) *it can be affirmed that even if one spends an entire lifetime discovering Italy, still many stones would be left unturned.* Scientific trips were to Università degli Studi di Firenze, Research Area of Sesto Fiorentino and CNR headquarters in Rome, in addition to my presence at IBIMET for six months with different scientists and experts.

My residence in Florence gave me the opportunity to explore the most important and beautiful art in *Florence's main squares and through its lesser-travelled side streets, visiting Florence landmarks such as the Piazza della Signoria where you can find beautiful outdoor sculptures; Piazza della Repubblica, once the old Roman forum with its Column of Abundance; cathedral complex, Piazza del Duomo, with the magnificent Gothic cathedral with its magnificent entrance doors; Ponte Vecchio bridge across the Arno with its numerous shops; and Piazza Michelangelo, which is on a hill on the south bank of*

the Arno River with panoramic view of Florence. Finally, my visit to Rome because of the Horizon 2020 Training Days which gave me opportunity to visit Rome landmarks such as Colosseum, Pantheon, Roman forum, Trevi fountain, Spanish steps, Vatican city and Altare Della Patria.



Figure 4.5: Picture during Diplomazia2 Training course

How Diplomazia2 Can Improve My future Perspectives:

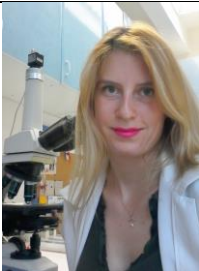
Research prospect: Diplomazia2 training program proved me with good experience and essential information in the field of climate change effects mitigation that will reflect on my future research interest especially related to plant protection, insect pest forecasting system and then ecological management for pests to magnify production of safety food. So my future research interests will be focused on using Geographical information system (GIS) and Remote Sensing (RS) and employing results of previous ecological and biological studies for pest to design models for forecasting population of pests under future climatic conditions then design safety integrated pest management programs compatible with future conditions and related insect

population growth. So heavy spraying of pesticides could be reduced and then safety food production could be achieved under future conditions. Furthermore, my research area will be wider to cover Mediterranean Basin Countries region.

Career prospects: As an assistant professor in the faculty of agriculture, I will make my students more aware of the impacts of climatic changes on food production and future of food production in Mediterranean Basin Countries region and how to design models to improve crop production. So, some syllabi of a few of my courses will have to be modified.

GORDANA DUROVIC

Montenegro



BIOSKETCH

I am an Entomologist and a researcher in plant protection. I hold an MSc in Agriculture with research done in Entomology. My interests include nature conservation and preservation of ecosystems. I don't agree with the use of commercial pesticides. Instead, I support more sustainable methods of integrated pest management in plant production. In the future, I would like to do research for sustainable strategies to control harmful pests.

Why I have applied for Diplomazia2 and expectations

At the time I applied for the Dimplomazia2 program, I had just finished a one year internship program in the entomology laboratory at University of Montenegro. I saw what Diplomazia2 offered as a great opportunity for my future career, because the scope of the program fit with my interests very closely. I aimed at broadening my knowledge in sustainability in agriculture, especially in sustainable crops protection, and learning more about the impact of climate change. I found the course design really interesting, especially because it allowed participants to expand their knowledge about adaptation of farming systems to climate changes, sustainable crop protection, plant's genetic resources, alternative methods of preservation (cryopreservation, tissue culture, etc.), the importance of mitigating the effects of climate change in primary production, and the development of new varieties of crops highly adapted to the changing conditions of the Mediterranean region.

One of my personal goals was to network and build new relations with scientists and other professionals. I seized this unique chance, hoping for future job opportunities as a researcher or for a PhD position. Also, I planned to invest some of the financial scholarship resources to complete some international exams and diplomas. Since I like to meet the locals everywhere I go and learn more about their way of living, it was clear from the beginning that this would be a great way to improve my Italian language skills.

My experience as Diplomazia2 Fellow

Today global food production is not equally distributed to all continents. The world is facing many problems in providing food for all. In 50 years, food will be scarce in many parts of the world. Global warming, draught, resistance of pests and other harmful organisms are rapidly increasing and the big question

arises on how to sustainably produce food in the future. Intensive agriculture and the use of synthetic pesticides destroyed the natural balance. Nematodes are one of most dangerous soil-borne microorganisms that feed mainly on plant roots. They can be migratory ectoparasitic or sedentary endoparasitic. They cause great loss in global crop production every year. They have so far been kept under control with organic fumigant nematocides, however, because of their harsh effects on the environment and beneficial organisms, such pesticides are being banned from commercial use.

Our aim in the biochemical laboratory I was assigned to, was to find efficient and environmentally friendly methods to make plants and crops more resistant to harsh environmental challenges such as biotic attacks. Our work focused on sedentary endoparasitic root-knot nematodes RKNs, *Meloidogyne* spp). We searched for chemicals and beneficial microorganisms which could activate the immune system of plants in their fight against biotic enemies, such as nematodes.

Plants develop defense responses to all kind of negative effects of the environment and biotic enemies (pathogenic organisms and herbivore insects). Biotrophic and necrotrophic pathogens have different infection and attack strategies and they build strong relationships with the host plant. Under attack, plants perform different defense responses by activating their immune system. The immune system can be triggered by primary attacks of pathogenic organisms; some molecular determinants, known as pathogen associated molecular patterns (PAMPs) are released in the apoplastic spaces of plant tissues where they are recognized by membrane receptor-like proteins known as pattern recognition receptors (PRRs); such a recognition leads to a PAMPs-triggered immunity (PTI), which is a basal, relatively unspecific, defense. PTI, however, can be overcome by pathogens by secretion of specific effectors directly into the plant cells.

These effectors are recognized by NB-LRR proteins encoded by R genes. These R-proteins trigger an immunity response, the so-called effector-triggered immunity (ETI), which is stronger than PTI and can lead to hypersensitive responses (HR) and cell death, which limits the spread of the infection.

The plant immune system is activated by plant phytohormones which are small signaling molecules, which also regulate many aspects of plant growth, photosynthesis, flowering, reproduction, seed production and response to environmental abiotic challenges. The plant immune system can act locally and systemically. Two main plant hormones are involved in plant immune responses. Salicylic-acid (SA) mediates Systemic Acquired Resistance (SAR) which is effective against biotrophic pathogens, while jasmonate acid (JA) and ethylene (ET) mediate Induced Systemic Resistance (ISR) effective against

necrotrophic microorganisms and herbivore insects. Investigations carried out in our lab have revealed that SA-dependent defense responses restrict nematode infection by decreasing the fecundity of nematode females, the number of egg masses. Between SA and JA signaling pathways there is a cross-talk, which favors plants attacked by different enemies.

SA accumulation in plant cells induces oxidative stress by the production of Reactive Oxygen Species (ROS) that are highly toxic for the plant. Plants have developed various molecular systems to cope with oxidative stress. When resistant plants recognize an avirulent pathogen, a hypersensitive reaction is produced causing cell death and tissue necrosis, which stop further development of the infection.

Plants can be sensitized for a more rapid and stronger defense response in a process called priming. Priming can boost the resistance of plants against biotic and abiotic stresses. Exogenously added SA, and its natural functional analogs like methyl-SA, or synthetically produced analogs such as benzothiadiazole (BTH) and 2,6-dichloroisonicotinic acid (INA) have been found to prime plants against RKNs by inducing SAR. Beneficial soil microorganisms such as symbiotic nonpathogenic Plants Growth Promoting Rhizobacteria (PGPR) and Arbuscular Mycorrhizal Fungi (AMF, *Glomus* spp.) or antagonistic symbiotic fungi such as some strains of *Trichoderma* spp., prime plants and enhance their immunity response (ISR, Micorrhiza Induced Resistance (MIR), Trichoderma Induced Resistance (TIR)). Priming enhances plant defense responses by accumulating inactive signaling proteins, which, upon the second exposure to a pathogen attack, make plant response more intense and faster.

In our laboratory we proved that SAR can be induced in roots against soil-borne parasites such as biotrophic root-knot nematodes (RKNs). During the last 6 months, our research has been focused on the search for the best dosage and application method of SAR elicitors to plants grown in pots in a glasshouse.

During this time, we conducted different experiments. We tested different doses of SA, JA, and other chemicals, such as strobilurins, and different beneficial microorganisms available as commercial products as potential resistance elicitors against RKNs, and the fitness costs of this effect by measuring parameters of plant growth and development. Tomato and eggplant were grown in glass house. Treatments were carried out on inoculated and un-inoculated plants, experiments included negative controls that were untreated inoculated and un-inoculated. Elicitors were added to plants by different methods: in one group of plants, the roots were immersed in product solutions before planting. In another group of plants, products were added to the soil as

soil drench. In a last group of plants, product was added as foliar spray. Later, the plants were inoculated with infective juvenile stage (J2) of the nematode *Meloidogyne incognita*. Assays of plant fitness were done at different time interval from inoculation as follow: plants were removed from their pots and the length and weight of the shoots and roots, and the number of branches were measured. These data gave us a good estimate of the plant fitness. Assays of the level of nematode infection in treated and not treated plants were carried out, as well. The number of egg masses, females, eggs were expressed per root system and per gram of root fresh weight. The number of sedentary forms (SF) developed per gram of root fresh weight was also calculated as it is a quantitative index of root galling.

Bioassays on plant-nematode interaction that were conducted in laboratory: i) isolation of nematode eggs from plant roots; ii) isolation of intact egg masses from roots; iii) hatching of infective juveniles J2 from eggs or egg masses; iv) inoculation of tomato/eggplant with root-knot nematodes (*Meloidogyne* spp.); v) preparation of samples for biochemical experiments; vi) isolation of females from roots; vii) preparation of plant tissue samples for miniaturized electrophoresis; viii) detection of proteins by the Folin method

From this training I learned: how to grow plants in the glasshouse, how to measure plant fitness, how to color egg masses, how to extract eggs from infested roots, how to count eggs, how to obtain from eggs/egg masses active juveniles, and how to infect plants in pots. I was trained on the preparation of different solutions and chemicals for lab research. I was trained to the use of a spectrophotometer and electrophoresis units.

I learned where to look for and how to identify important data from literature.

Overall, my experience with Diplomazia2 exceeded my expectations. I was selected to do my training in an area that was completely new to me. This turned out very fortunate since I am a young researcher and it allowed me to expand my knowledge and learn new things that could be useful in my professional future. Just prior to my arrival at the biochemical laboratory, I participated in a basic master course in nematology. In the lab, I gained a lot of practical knowledge necessary to conduct experiments. At first, my training was very challenging because I had only basic knowledge on the subject. It was difficult to understand the biochemistry of plants immune system and the role played by the multitrophic interaction between plants, microorganisms and nematodes in host plant recognition and susceptibility.

The Diplomazia2 program provided participants with a monthly scholarship payment that covered more than just the basic expenses and allowed for an enjoyable stay all around. I was able to afford convenient accommodation, daily lunch in a local restaurant and experience local food. I spent some of my resources on visiting historical sites and to witness the natural beauty of Puglia and Campania and to enjoy the Barese life-style. I made lots of friends traveling during free time. I even found some sparetime for salsa dancing and had a great time with my friends.

I participated in several extracurricular courses. I completed an intensive Italian course for foreigners (B1). I got a certificate for attending a preparation course for TOEFL, passing the exam successfully. I also attended a course on “The future food production: crops” - online at Wageningen University.



Figura 4.6: a) Counting egg masses in the biochemical laboratory. b) Experiments on young egg plants in the glass house

How diplomazia2 can improve my future perspectives

In a rapidly changing world, working with sustainability and solving problems that modern societies are facing, is of the utmost importance, especially for young and ambitious researchers. No doubt that Diplomazia2 provides this opportunity by offering a wide selection of courses, as well as the chance to connect with many scientists involved in lectures and education. In my opinion, the most important aspects of Diplomazia2 are the practical work and training in the laboratory facilities and the personal contact with experienced researchers. One aim of Diplomazia2 is to connect researchers with different backgrounds and education. With respect to this, my expectations have been fully met by the program.

I arrived in Bari with high expectations, first and foremost, of course, I hoped for a good education and new skills in the area of sustainable crop protection. However, I got more than I expected. I have unexpectedly gained insight in how to conduct research in a biochemical laboratory of nematology. With this additional knowledge, I can surely arrange similar experiments in labs of my home country.

Having worked with CNR enriches my biography and improves the outlook for my professional future. During this training program, I started to be more interested in the multitrophic interaction between organisms and sustainable plant defense systems, which was not the case before my arrival.

During frontal lectures, I observed entertaining ways to present and explain problems to participants. Different lecturers gave presentations with different teaching strategies. This inspired me for my own future presentations. These lectures taught me much about plant genetic resources, cryopreservation, tissue culture, and the importance of mitigation of climate change effects. I developed new ways of thinking and discovered new possible solutions for some agricultural problems or the mitigation of harmful effects caused by pests and pathogenic microorganisms.

Diplomazia2 significantly changed my life and will continue to shape my future. My tutor recognized my potential as a future researcher and he suggested me to follow my interests. He recommended me for a research position offered by the Fondazione Edmund Mach. I got the job offer and gladly accepted it. I would like to thank all of Diplomazia2's team for giving me the chance for this awesome experience. Most of all, I would like to thank my tutor Dr. Sergio Molinari for his support and everything he taught me.



Figura 4.7: a) Montenegrin participants of Diplomazia2 in Rome b) Marveling at ancient history of Pompeii



BIOSKETCH

Assistant professor in plant virology in (ESAK) Higher School of Agriculture of Kef Since 2013 till now.

Assistant in Dryland Institute of Medenine (IRA) from 2011 till 2013.

I like travelling and discovering other cultures

I like humanistic sciences and psychological analyses, History, documentaries and movies. I love walking, eating and I'm fan of shopping.

Why I have applied for Diplomazia2 and expectations

I have applied to Diplomazia2 because I'm trying to learn new techniques in my specialty and because I would like to collaborate with a high qualified laboratory. In fact, three of my friends (2 Egyptians and 2 Tunisian) were previous alumni of Diplomazia1 course and encouraged me to participate. Also I already obtained my master's degree and PhD in Italy between Bari and Bologna, so when this opportunity came, I took it because I had nostalgia of this lovely country since it gave me the chance to pursue my master's and Phd.

My experience as Diplomazia2 Fellow

Experience during Diplomazia2

I was very lucky to be hosted in a very dynamic group of research which has a leading position in grapevine and more broadly, woody crop virology. The research group is now deeply involved in facing the *Xylella* outbreak in Olive, coordinating two EU Projects on the subject.

During the six months traineeship, I learnt how to organize and plan researches in laboratory for the study of plant pathology. I worked on more projects, thus I acquired versatile experiences both about basic methods used in molecular laboratory, and the progress of scientific researches.

I attended a conference on 14 June 2017, organized by the virology laboratory on Nutritional elements moving in the xylem influence the virulence of *Xylella fastidiosa* presented by Prof. Leonardo de La Fuente and another presentation entitled "Vectors of *Xylella fastidiosa* in Brasil: ecology and control" presented by Prof. João Roberto Spotti Lopes).

The group has a very high scientific quality; hard workers, available, humane and tolerant, we could even celebrate our religious feasts with them. By my

tutor and colleagues, I was encouraged to improve my English and Italian as well.

Also, as DIPLOMAZIA2 fellow, I attended many courses from 2 May till 29 May presented by 10 researchers affiliated to 4 different CNR institutes (IBIMET, IVALSÀ, ISPA, and IPSP).

The topics were dealing with Climate change and crop modelling, wood formation, Plant biotechnology, in vitro culture, mycotoxin (biodiversity, detection, management...), methods of detection and NGS in plant protection.

We attended the Horizon2020 Training Days on European Institutions and European research programs strategies, from 6 to 7 June 2017, at CNR headquarters in Rome.

I also enjoyed the group of DIPLOMAZIA2 project of Bari. It is one of the best and special groups, that despite the religious, ethnic, ideological differences, has found a shore of understanding, peace and compassion. We are always united, planning and organizing to do things together.

Activities report

I spent my training period at the Consiglio Nazionale delle Ricerche, Istituto della Protezione Sostenibile delle Piante (IPSP), Bari via Amendola 122/D (www.ipsp.cnr.it), under the supervision of Dr. Pasquale Saldarelli, Senior scientist (pasquale.saldarelli@ipsp.cnr.it).

The laboratory of plant virology carries out diverse research activities related to obligatory pathogens of woody plants, and recently to *Xylella fastidiosa*, which is causing an outbreak on olive in Apulia.

Activity 1: Monitoring of *Xylella fastidiosa* and its vector by Real time PCR

X. fastidiosa is a bacterial pathogen transmitted by several sharpshooters in two tribes of Cicadellinae (Proconiini and Cicadellini) (Marucci et al 2008). It was first recorded in 2013 in southern part of Apulia, Italy, where it is causing serious damage to olive groves. The isolate which has been detected in Apulia belongs to the subsp. Pauca (Saponari et al., 2013; Giampetruzzi et al., 2015). In addition to olive trees, the bacterium has been detected in numerous other host plants (Cherry and almond trees) and mainly ornamentals (*Polygala myrtifolia*, *Nerium oleander*, *Laurus nobilis*, asparagus_.), but extensive studies demonstrate that it is not infections in grapevine.

Because of this outbreak, which represents the first detection of this quarantine pathogen in Europa a project has been funded under the EU

Program Horizon 2020 (Ponte, Pest Organisms Threatening Europe grant agreement No 635646).

The CNR-IPSP-Bari is the reference laboratory for the detection and monitoring of *Xylella* in Apulia. Plant samples are tested for the presence of the bacterium by real time PCR (Harper et al., 2010). This analysis requires the following tasks:

Tasks

- Isolation of xylem-enriched tissues from olive twigs
 - CTAB-BASED Total Nucleic Acid extraction from plant tissues
- Quantitative real time PCR
- In parallel, I was involved in several diverse research activities aiming:
 - To Study the resistance of the cultivar Leccino in comparison with the susceptible cultivars Cellina di Nardò and Ogliarola salentina.
 - To acquire a thorough knowledge of the composition of microbial communities inhabiting the xylem vessels of olive cultivars showing different susceptibility to Xf infection
 - To identify potential vectors of *X. fastidiosa*
 - To verify Xf acquisition and transmission by *Philaenus*
 - To study the spatial distribution of *Philaenus* inside the orchard of olive: The dispersion of adults of *Philaenus* in the orchard is studied using a novel mark–capture technique (Lessio et al., 2014). The technique is based on the marking of the insects with albumin. Dispersed insects are captured by yellow sticky traps placed on the canopy of olives and analyzed by ELISA using anti-albumin specific antibodies.

Activity 2: Detection of GFLV, ArMV, GLRaV-1 and GLRaV-3 in a single tube real-time PCR based on melting curve analysis with EvaGreen

Based on EU Directive 2002/11/EC, grapevine stock material for vegetative propagation should be free of *Grapevine fanleaf virus* (GFLV), *Arabis mosaic virus* (ArMV), *Grapevine leafroll-associated virus-1* (GLRaV-1) and *Grapevine leafroll-associated virus-3* (GLRaV-3). Bioassays and serology have been widely used for the detection of grapevine viruses, but more recently, nucleic acid-based methods started to be widely applied. Traditional gel based PCR technology for the simultaneous detection of several viruses in a single tube is only possible when working with different fragment sizes.

This technique, however, is time consuming and exposed to potential carryover contamination (4). Due to the absence of post-amplification procedures, multiplex real-time PCR allows rapid analysis with a larger sample throughput (5) and limits carry-over. A method based on TaqMan® probe real time multiplex RT-PCR was developed to detect grapevine viruses regulated by the EU Directive 2002/11/EC,

The objective of this experiment is to design primers that multiply simultaneously the four following grapevine viruses: GLRaV3, ArMV, GFLV, and GLRaV-1 in the same sample.

The aim of this work was to test if the sensitive, fast and easy-to-use multiplex PCR with melting curve analysis reaction, based on EvaGreen® intercalating agent (EG-MUX-PCR), will have the same specificity with SyberGreen to evaluate the presence/absence of GFLV, ArMV, GLRaV-1 and GLRaV-3 in grapevine nucleic acid extracts.

Results of this work show that SYBRGREEN is less sensitive than EVAGREEN.

Activity 3: Detection of Tunisian grapevine viruses

The work consisted in the assessment of the sanitary status of a small number of Tunisian grapevines. Detected viruses are those included in the Italian regulation for production plant propagation material (*Grapevine virus A*, *Grapevine virus B*, *Grapevine leafroll-associated virus 1, 2 and 3*; *Grapevine fanleaf virus*; *Arabis msaic virus*; *Grapevine fleck virus*). Viruses were detected by real time RT-PCR reverse transcription polymerase chain reaction.

Tasks:

- Extraction of total RNAs from grapevine leaf tissues
- Spectrophotometric determination of the concentration of total RNAs
- Synthesis of the cDNA by random primers and M-MLV
- Real time PCR with specific primers

Assays showed that Tunisian grapevines have multiple infections with GFkV, GFLV GVA, GLRaV-2 and GLRaV-3.

Activity 4: Development of an infectious cDNA clone of GPGV

Grapevine Pinot gris virus (GPGV), belongs to the genus *Trichovirus* of the family Betaflexiviridae, was first identified by siRNA sequencing in northern Italy in 2012, in the grapevine varieties Pinot gris, Traminer, and Pinot Noir, which exhibited mottling and leaf deformation (Giampetruzzi et al. 2012). The virus is also present in asymptomatic vines, with a lower frequency.

Since 2012, this virus has also been reported in, Slovenia, Greece, Czech Republic, Slovakia, the Czech Republic and southern Italy, Bosnia and in France, Portugal, Hungary, Romania, Serbia, Spain, Croatia Uruguay and Ukraine. Outside Europe, South Korea, China, Georgia, Turkey and USA.

GPVG is not transmissible and does not replicate in an herbaceous host, which limits studies of plant /virus interactions and the development of serological reagent for virus detection.

The availability of a full length cDNA done of GPVG able to infect and replicate in the herbaceous host *Chenopodium quinoa* would facilitate these studies.

For that purpose the following tasks were implemented:

Tasks:

- Purification of plasmid DNA for the cloning of the full length cDNA of GPVG under the control of the Ca35S promoter (pCass2, pBin61)
- Long template amplification of the GPGV full length cDNA
- Elution of DNA fragment from agarose gel, precipitation
- Ligation of the full length cDNA to the linearized plasmid and transformation into *E. coli*
- Digestion of recombinant plasmids by different restriction enzymes

In parallel the infectivity of an already available full length cDNA of GPGV, under the control of a T7 RNA polymerase promoter was evaluated.

Tasks:

- Transcription of the obtained GPVG full length cDNA by T7RNA polymerase and klewnov.
- Inoculation of the synthesized RNA to *Chenopodium quinoa* and *Nicotiana benthamiana*.
- Evaluation of the infection by RT-PCR with specific primers.

Results:

the inoculation of *Chenopodium quinoa* by the transcribed RNA was not successful.

Activity 5: Viral diseases of cucurbitaceous

Viral diseases are numerous and harmful in cucurbitaceous. Molecular analyzes were carried out to determine their etiology of in Tunisian samples.

Symptoms observed

Symptoms of viral infection have been observed on plant samples of cucurbitaceous from Tunisia, including dwarfing plants, affecting leaf pigmentation (mosaic, spotting, speckling, chlorosis) and shape (crinkling, deformation), and fruit (appearance of cracks at an advanced stage of attack).

Tasks

- Total RNA extraction with a CTAB protocol
- Synthesis of cDNA
- PCR analysis with specific and universal primers
- Cloning (ligation and transformation)
- Sequencing of the cloned PCR products
- Analysis of the sequences by Bioinformatic tools

Results:

The RT-PCR analyzes carried out on 40 Cucurbit leaves of the following species of melon (*Cucumis melo*) and cucumber (*Cucumis Sativus*) revealed the presence of the following viruses with different percentages of infection: Squash Mosaic Virus, SqMV (45%), Cucurbit aphid born yellows CABYV (20%) and Cucurbit Yellow Stunting Disorder Virus CYSDV (7.5 %). Direct PCR with universal primers of the genus Begomovirus followed by cloning and sequencing revealed the presence of (30%) of Tomato Leaf Curl New Delhi Virus, ToLCNDV with 98% of similarities. It should also be noted that mixed infections by two or more viruses are frequently encountered, which explains the severity of symptoms on cucurbits grown under geothermal greenhouses in South Tunisia.

My experience in Italy

I had the opportunity to discover Italy and especially the Apulia region: Lecce, Matera, Ostuni, Alberobello, Trani, Puglianano mare, Conversano, Grotte di Castellano....

The experience in this beautiful country improves my cultural response. It is not something easy, in fact it requires openness to the viewpoints, thoughts, and experiences of others. This is not about changing others to be more like you, or to change yourself to please them. Instead, it is about exploring and honoring the differences of others. In fact, developing a cultural-responsive attitude is a life-long journey.

I like the Italian life style where the food is an art and I appreciate how Italian people are enjoying life, they are doing things with love and devotion. I think that they are one of the most joyful and positive people in the world since I hear always the positive words “Che bello, bellissimo, Molto bello....”

I think that they have to teach the world some aspects of human development...

Generally speaking Italian are tolerant, open-minded, nice and not judgmental but ignorant people may exist everywhere and prejudices from both parts are common: misjudgments about Muslim and Arabic people may exist, especially with what the media is spreading but sometimes just a smile can change some attitudes...

How diplomazia2 can improve my future perspectives

The collaboration of the laboratory of virology will bring publications and therefore the scientific network that we have built will lead to future projects.

I know that people of the group will share with one another the news on possible future Calls for training, workshops, conferences and opportunities etc.

Beyond the scientific profit, I think and hope that the friendships established with different members of DIPLOMAZIA2 group will lasts forever.

LAMA SOUEIDAN

Lebanon



BIOSKETCH

Lama Soueidan, born in Beirut , Lebanon. After graduation from my high school, I moved to Lyon (France) to study biochemistry at the university of Claude Bernard Lyon 1. Once I obtained my Masters in structural biochemistry, I was accepted for a PhD at the Ecole Nomal superieur, where I graduated in February 2015 with a doctorate in life sciences. Since then I worked as a biochemical engineer in a laboratory of molecular and cellular Biology.

I have many passions in life, among them, cinema, political science and traveling. I also practice some sports such as badminton, squash and swimming.

Why I have applied for Diplomazia2 and expectations

When I first heard about Diplomazia2, I got very excited to the idea of learning more about climate change and its impact on our agriculture and our behavior. However, I am a biochemist and I never attended any agriculture course, so it was an opportunity for me to add a new set of skills to my curriculum vitae. In addition, living 6 months in Italy and discovering the culture and the food that I heard so much about, would always be a plus. So I applied to DiplomaZia2, knowing that at the end of the 6 months, I would have learned more about climate change which should be a concern for every citizen of this earth.

Even though, the modality of this training were not fully explained to us before or after applying, I was expecting 6 month full lessons learning about sustainable agriculture and climate change but I was very delighted when I went to the institute to learn about the research and practical part.

My experience as Diplomazia2 Fellow

From the first day of Diplomazia2, I was immersed in the world of nematodes and plants, discovering a whole new world that I never expected. Alongside my tutor, Prof.ssa Paola Leonetti, discussed of a work plan where I can put my knowledge to work while learning about nematodes and plants. The project I worked on during these 6 months evolved around understanding the plant-pathogenes interactions. Plant pathogen interaction is a well understood mechanism which involves the activation of signals sometimes resulting in a rapid defence response against an array of plant pathogens. In order to study these genes expressions, we used molecular biology and biochemical

techniques such as retrotranscription, PCR, Real time PCR, DNA and RNA extraction from plants. I extracted DNA and RNA from infected and uninfected important agricultural crops as tomato (*S. lycopersicum L.*) and particularly legumes (*Pisum sativum L.*, *Cicer arietinum* etc.). On these samples I performed a series of experiments to track the genes expression of genes involved in epigenetic mechanisms or pathogenic related genes. DNA methylation is a conserved epigenetic modification involved in many biological processes. It is responsible for regulation of gene expression patterns and genome stability thus its importance. I worked on different families of methyltransferases and DNA demethylases. As I mentioned before, I worked also on pathogenesis related protein, which are induced in several plant species when they are infected by nematodes, viruses, viroids, fungi or bacteria. The occurrence of these proteins is not pathogen-specific, but determined by the type of reaction of the host plant. Working on plants allowed to widen my experimental knowledge in order to perform these experiments. Prof.ssa Leonetti and I hope to expand our collaboration beyond DiplomaZia2 and we presented an abstract just accepted to a joint Congress SIGA-SIBV ("Sustainability of agricultural environment: contributions of plant genetics and physiology", Pisa, September 2017)



Figura 4.8: pictures of my experience during DiplomaZia2

My experience during Diplomazia2

I would describe my experience during Diplomazia2 as very rich on a personal and a professional level, thanks to the efforts that my tutor has done to integrate me into her team and onto her projects. From the moment I landed, she welcomed me and helped me with my accommodation and administrative paperwork and shortly afterwards, she trusted me with her scientific projects and gave me the opportunity to learn from her and her team including Enzo Radicci, Giovanna Linguiti and Luciana Savino. However, the theoretical part of Diplomazia2 was a little bit more chaotic because of the last minute organization and connection problem of the skype conference calls. I would have loved to meet other trainee (from the same course) from the other cities which would allowed us to bond and discuss our projects more often. Moreover, we could have organized a meeting with our lecturer (in each city) which would have made communicating with them easier and would have allowed us to check out their facilities and equipment used from their research. Overall, my experience with DiplomaZia2 was very successful.

My experience in Italy

There are two great things in Italy, Italian people and food. Since I have already lived in a European country for many years I did not expect to see this much difference in culture between two neighboring France and Italy. The first thing I noticed in Italian people, particularly “barese”, is their kindness, whether they are young or old. Since I did not speak Italian very well, they did everything in their power to help me, whether I was working in the lab or buying fish at the fish market. I also had the chance to visit the Puglia region (Alberobello, Matera, Lecce...), Naples and Roma. Moreover, each of these cities had its own identity, culture and cuisine.

Italian food is one of the most famous food in the world, however I realized that I did not know what a pizza should taste like before eating a pizza here in Italy (especially Napoli). I also got to discover new Italian flavors, specially apulian such as : burrata, capocollo, orecchiette con cima di rape, ragu’ di bragirole and many more. I can go on for days about Italian food, and now I understand why Italians are very proud people.



Figura 4.9: Pictures in Italy

How diplomazia2 can improve my future perspectives

As I mentioned earlier, I applied to DiplomaZia2 thinking about the new skills I can acquire joining such a program. Moreover, unlike other DiplomaZia2 trainees, I don't have a permanent job and I would hope that these new skills and knowledge could be useful for me while searching for a new job.

Working in plants and nematodes allows me to open furthermore my knowledge into the biological systems. Having worked already on human and animal cells, I can now add plants which opens up more opportunities for me.

I did not only add technical and practical skills to my curriculum, I also added a new language. Even though I don't speak a very good Italian yet, I can speak it on a basic level and understand it very well.

In addition, Diplomazia2 allowed us to be in contact with many professors / researchers that can only enrich the list of professional contacts in my circle of acquaintances. These contacts can later be used to develop a professional relation between us or our institutes, leading to international projects.

So I am looking forward to use all the knowledge and experience I learned during these 6 months in my next projects.



BIOSKETCH

I am an assistant professor at Institut Supérieur de Biotechnologie de Béja, Béja, Tunisia.

My first contact with research field took place during my final year project for agro-food industry engineering degree from Institut National Agronomique de Tunisie. As I appreciated that part of work, I continued on the same subject for my research master project. For my PhD research, I enlarged the areas of study and visited various laboratories namely Laboratoire des Interactions Moléculaires et Réactivités Chimiques et Photochimiques, Toulouse and Laboratoire de Génie Chimique à l'INSAT-INP, Toulouse, France. My postdoctoral research at Laboratory of Bioorganic Chemistry in Trento, Italy deepened the secondary metabolites study.

I started my career as a part time lecturer at Université Libre de Tunis, then joined as assistant professor the Institut Supérieur de Biotechnologie de Béja. I am realising my research as a member of Laboratoire des Matériaux Molécules et Applications, l'Institut Préparatoire des Etudes Scientifiques et techniques, La Marsa.

Our research topics are natural products chemistry, secondary metabolites extraction and purification, biological activities investigation.

I have a great passion for reading in all the languages I know (Arabic, French, English, and Italian).

I am fond of travelling and discovering new places and new cultures.

Why I have applied for Diplomazia2 and expectations

While making a search on internet, I found about the opportunity to apply for this CNR-sponsored program (CNR is a very prestigious research center) on the topics of management and use of food resources aimed at the sustainability of agriculture and forestry, and at the mitigation of the physical and biological impacts of climate change. As I have a background of food industry engineering, I thought this would be a very important opportunity for me. I believed that this course will allow me to develop the skills I already have, and

acquire new ones. I also felt that this training will give a significant contribution to my carrier.

I expected to deepen my knowledge about the climate change impact on food resources. I also was curious about the agriculture and forestry sustainability which are important topics for the human kind as we are facing an important decrease in plant resources.

My experience as Diplomazia2 Fellow

My training within Diplomazia2 project was articulated around three main axes.

- The first one was about theoretical courses that covered the following subjects:
 - Climate change
 - Vegetal biodiversity and its biotechnological applications
 - Climate change impact
 - Vegetal biotechnology and in vitro production
 - Mycotoxins prevalence in food, feed and its analyses methods.

- The Second part was laboratory activity concerning mainly evaluation, separation and identification of various fungi in wheat. A batch of 18 samples gathered from different regions in Italia was considered. All the undertaken analysis are detailed below:
 - Random sampling.
 - Seeds sterilization using 2% hypochloride solution for 2 minutes.
 - Thoroughly rinsing with sterilized water twice.
 - 100 seeds were placed on petri dishes filled with PDA and PCNB nutritive medium. The incubation took 5 days at $25\pm 2^{\circ}\text{C}$ with a photoperiod of 12 hours.
 - After the incubation the fungal contamination was counted taking in consideration a special interest on the species *Fusarium*, *Alternaria*, *Penicillium* and *Aspergillus*.
 - A monospore petri dish is prepared from the detected species by means of a conidia suspension on agar medium than a monospore is cut and re-inoculated on PDA for 12 hours at $25\pm 2^{\circ}\text{C}$.
 - The last petri dishes allow morphological identification by microscope.

- The third part covered the participation in diverse scientific meetings and workshops in Italy.

- The first Mycokey general assembly held in Bari, 14-17 March 2017 organized by Istituto di Scienze delle Produzioni Alimentari, Consiglio Nazionale delle Ricerche Bari. MycoKey is the new project funded by European Commission under Horizon 2020 programme, Societal challenge 2 “*Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy challenge*” – topic “Biological contamination of crops and the food chain”. This assembly gathered all the research groups (European and extra European) involved in Mycotoxins project: mycotoxins presence, detection, treatment and prevalence.
- Training days on “European Institutions and European research programs and strategies” held at CNR headquarters Rome, 6-7 June 2017.
- The XVth Congress of the Italian Society of Phytochemistry jointly with the 1st International Congress on Edible, Medicinal and Aromatic Plants (ICEMAP 2017) held in Pisa, 28-30 June 2017. This conference was focusing on the ultimate scientific findings about edible medicinal and aromatic plants, their biodiversity and conservation; isolation and structural elucidation of natural products and their bioactivity.

As a Diplomazia2 fellow, and living for six months in Bari, I came to know all my colleagues (Diplomazia2 fellows) in this big research center, they were from different courses and it was as if we created a big family. As we were all curious to discover Puglia, we tried to organize various visits to the surroundings areas and cities. It was a wonderful discovery every time. We went to Polignano a mare, Alberobello, Conversano, Trani, ... And we also got the opportunity to visit the marvelous Napoli and Pompei. Taking profit of the conference that took place in Pisa we also visited Pisa. One of the important moments was the workshop in Rome where we all were gathered from the different cities and research centers spread in Italy and we roomed in Rome all together.

A very important point to be considered of the richness I got during my stay in Italy is the incessant discoveries and surprises of the Italian kitchen and especially the Pugliese with all its varieties: pizza, focaccia, orecchiette, taralli, burattine, stracciatella, and the wonderful coffee for sure.

So for me being selected to take this fellowship, allowed me to get insights about the Italian culture (sculptures, paintings, calcio,...) and deepen my knowledge of Italian as a spoken language.

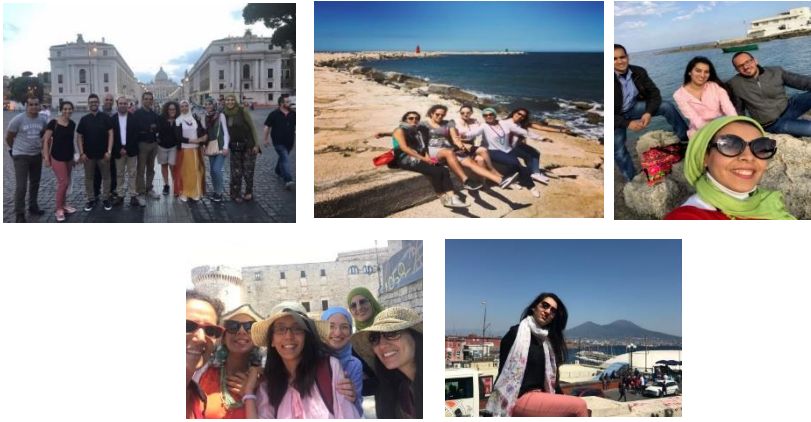


Figura 4.10: Pictures during my experience in Italy

How diplomazia2 can improve my future perspectives

I was very lucky to be hosted at ISPA-Bari and especially to be added to Pr. Antonio Moretti team as the studied subjects and research areas are highly related to my interests.

First of all I learned a variety of tests and could apply the gained analytical skills in the laboratory, so I can now make the know-how transfer both to my teaching institute and research laboratory in Tunisia. This could be an important propelling starting point to my career as a young scientist. Moreover, I developed an important network with CNR scientists and researchers especially on mycotoxins research subjects that are critical subjects for food security.

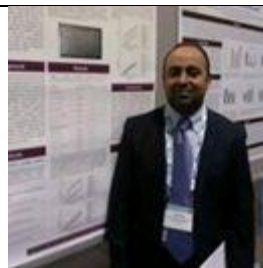
For the moment we are trying to prepare a text for a joint collaboration between the two research institutes (ISPA, CNR/Bari and LMMA, IPEST, Tunis) which will take into consideration an exchange of both students and researchers.

Another subject of interest for both institutes would be the identification of fungal species from Tunisian cereals and ways of treating them efficiently since my teaching institute is located in the highest producing region of cereals of Tunisia.

So we can consider that my stay as a Diplomazia2 fellow is a starting point to an important collaboration between my country and Italy and especially the research area in Bari. Further parties can be considered for an involvement in the research projects if they show interest in deepening the established research areas.

MOATAZ MOUSTAFA

Egypt



BIOSKETCH

I am currently an Assistant Professor at the Department of Economic Entomology and Pesticides, Faculty of Agriculture, University of Cairo, Egypt. I have some duties at **research level including**; writing research proposals, and publications, reading academic journals, supervising Msc. and PhD students and research staff, attending and speaking at conferences and seminars, and establishing collaborative links outside the university with industrial, commercial and public organizations. **On the Educational level, I have to** deliver lectures, seminars and tutorials, developing and implementing new methods of teaching to reflect changes in research, designing, preparing and developing teaching materials, setting and evaluating examinations, supporting students through a pastoral or advisory role, and carrying out administrative tasks related to the department, such as student admissions, introduction program and involvement in committees and boards. **For hobbies and sports**, watching TV, computing (internet and software programs), reading books, and playing football are the most interesting things that I do.

Why I have applied for Diplomazia2 and expectations

Diplomazia2 training program has three different courses (branches). Second course which I applied for, deals with the agriculture and food production which encouraged me to apply. Therefore, one of the main institutes which participate in that program is the institute of plant protection. Since my research area is to screen the response of some biological control agents that reduce the insecticides application in order to find an effective alternative method for controlling pest to reduce using pesticide and their side effect in the consumer, and sustainable intensification of agricultural production, I thought that if I could enroll in that institute, I would gain new practical approaches related to plant protection, and, after returning, to be able to collaborate with Egyptian quarantine for rapid identification, detection and diagnosis of agricultural pest. Therefore, I expected that this program could give me the opportunity to enrich my professional experience in the branch of

biotechnology for pest control, and in what I am interested in, and for planning my work in the future as well.

My experience as Diplomazia2 Fellow

Training programme of Diplomazia 2 could be divided into several parts including the expiemental research, courses, and workshop;

Experimental research:

Aflatoxins and fumonisins are the most common mycotoxins found in corn kernels throughout the world. These toxins have been shown to cause a number of health problems in animals and have been associated with an increased incidence of human cancer. Although several preventive strategies to reduce the formation of mycotoxins are applied, it is sometimes very difficult to control mycotoxin contamination in the field and during storage.

Mycoremediation research is now considered as a promising approach to develop novel and efficient strategies of degradation and transformation of toxic organic pollutant. White-rot basidiomycetes fungi, such as *Pleurotus spp.*, are considered functional foods in many countries and play a very important role in many biotechnological processes.

The genus *Pleurotus* includes 40 species and are the second most important cultivated mushrooms in the world. Basidiomycota are among the most powerful organisms for biodegrading and decontaminating a wide range of chemicals and environmental pollutants.

The aim of the research was used as a biosorbent dead biomass of *P. eryngii* ITEM 13681 mycelium to remove aflatoxin B₁ from acetate buffer (pH = 5) and phosphate buffered saline-PBS (pH = 7). The advantage of using dead fungal cell is the lack of waste toxicity and the possibility of easy storage and for long periods.

Pleurotus eryngii ITEM 13681 mycelium was cultured on MEB during 20 days at 28 °C in the dark. For preparation of biosorbent the mycelium was harvested, autoclaved for 15 minutes at 121 °C and lyophilized during three days. It was blended at high velocity to powered and then sieved to size ≤ 500 µm. The effect of mycelium dosage was studied by using different amounts of biomass (25, 50, 75, 100, 150, 200 mg per 1 mL) while keeping other parameters constant. This study was tested in triplicate. The biosorbent was weighted in a 2 mL eppendorf tube and suspended with an appropriate volume of aflatoxin B₁ 0.5 µg/mL in acetate and PBS buffer. The suspension was shaken for 90 minutes, 250 rpm speed at 25 and 37 °C. After the incubation period, the samples are centrifuged at 13000 rpm for 10 minutes. Supernatant sample was removed and the pellet was washed three times and analyzed by UPLC/FLD. The efficiency of adsorption (%A) were calculated using following equation:

$\%A = ((C_i - C_f) / C_i) \times 100$; where C_i is the initial and the C_f final concentration (supernatant plus washing solution) of mycotoxin.

The percentage of aflatoxin B₁ adsorption in both buffers was higher at 37 °C than 25 °C and it was significantly effective with the increase of mycelium

dosage. It doesn't observe significant adsorption at 25 mg in buffer acetate and using 200 mg of mycelium was obtained 44 ± 4 %.

The percentage of aflatoxin B₁ adsorption in PBS was from 7 ± 5 % at 25 mg to 64 ± 6 % at 200 mg of mycelium at 37 °C while from 3 ± 0 % at 25 mg to 26 ± 3 % at 200 mg of mycelium at 25 °C.

The results obtained demonstrate that *Pleurotus eryngii* mycelium can be used as cheap and effective biosorbent capable to remove aflatoxin B₁.

How diplomazia2 can improve my future perspectives

To keep updated with the demands of an increasing world population, a 70% increase in global food production is needed by 2050 (UN), requiring sustainable intensification of agricultural production. Effective pest management and developing strategies to minimize and detoxify mycotoxins contamination through the food chain are crucial and central to meeting this goal. The proposed program and visit could involve a laboratory research into mechanisms that facilitate simultaneous use of bio-control agents in the food contamination.

This program will help materialize my research vision for improving environmentally sound strategies of plant protection and food production. Therefore, it will help me developing pest control management that solves many serious problems of current pest control in Egypt. Moreover, I believe that this program will develop international research and collaboration between Italy and Egypt. In addition, the advancement of my academic career in Cairo University requires to improve my scientific knowledge and increase my international collaborations and publications. Finally, this program offers the opportunity to continue working in the branch of biotechnology for pest control that I'm interested in and planning to work in that field in the future as well, which it will have a direct impact on future agriculture in Egypt.

ABDELGAWAD SAAD

Egypt



BIOSKETCH

I am currently working as a researcher at Biological Engineering Dept., Agricultural Engineering Research Institute (AEnRI), Egypt. I obtained a PhD in Agricultural engineering, Ain shams University, Egypt in 2012. A Visiting Fellow in Faculty of Bioscience Engineering, KU Leuven, BELGIUM 2016. Postdoctoral Fellowship in Szent István University (SZIU), HUNGARY 2015 & Punjab Agricultural University, INDIA 2014.

I was deputed by the Diplomazia2 project to The Institute of Sciences of Food Production (ISPA – CNR), Bari, Italy, to carry out Training and research work on a project titled " USE OF FT-NIR & FT-MIR SPECTROSCOPY FOR RAPID DETECTION OF MYCOTOXINS IN CEREALS" under the supervision of Dr. Annalisa De Girolamo, Institute of Sciences of Food Production ISPA, Bari.

Interests and experience in a Post-Harvest Engineering and Technology of food products, Especially in Nondestructive technology as Vis/NIR Spectroscopy, Hyperspectral Imaging. Hobbies and interests: Socialising with friends and family, watching TV, computing (internet & many software programs), reading non-fiction books and playing football on a weekly basis.

Why I have applied for Diplomazia2 and expectations

I expected to learn a new system in auto mechanization field and modern agricultural technologies for sorting and food evaluation quality. I want to learn new applications of Nondestructive technology for food sorting to improve the food security schemes. I expected to gain a new practical approach related to that technology and writing a good research paper. Thus, I was expecting that this program could offer me the opportunity to enrich my professional experience in the branch of Bioscience Engineering for Post-Harvest Engineering Technology. I had hoped this program would help me take a role in a high Tech agriculture project and participate in sustainable development

projects. Besides, maybe it could add more value to my future researches in Post-Harvest Engineering Technology field.

My experience as Diplomazia2 Fellow

Activities and research work done under DIPLOMAzia2 Fellowship included three parts: theoretical, practical parts and workshops.

First, Theoretical courses

The lectures were done by CNR tutors from 2nd of May to 14th of June 2017. The theoretical course improved our background about some agricultural and environmental studies.

Second, practical research activity:

Experimental research or study focused on the use of Fourier Transform (FT) near infrared (FT-NIR) and mid infrared (FT-MIR) spectroscopy as a rapid detection of mycotoxins in wheat and maize.

The objectives of this work: Mycotoxins are toxic secondary metabolites produced by filamentous fungi on agricultural commodities in the field and during storage. Mycotoxin contamination of agricultural food commodities and beverages poses a risk to human and animal health due to their toxic effects. In Europe harmonized maximum levels for mycotoxins in foodstuffs have been specified in the Commission Regulation EC 1881/2006 and its amendments. Effective and reliable analytical methods are required to identify and determine mycotoxins at legislated levels and enforce regulatory limits. So, the techniques for detecting known mycotoxins are very advanced and are mainly based on high-performance liquid chromatography (HPLC). Effective monitoring of mycotoxin should be undertaken and achieved through reliable and rapid analysis. Consequently, increased efforts have been made to develop analytical methods suitable for rapidly detecting. This present work focuses on the potential of using FT-NIR and FT-MIR technology a rapid screening tool for the analysis of ochratoxin A (OTA) in wheat and fumonisins in maize. In particular, Partial-Least Squares-Discriminate Analysis (PLS-DA) and Linear Discriminate Analysis (LDA) classification models with several data pre-processing methods were compared to determine the best suitable approach for this type of data analysis.

Summary of Results:

Rapid and inexpensive methods using Fourier-Transform-Near Infrared (FT-NIR) and Fourier-Transform-Mid Infrared (FT-MIR) spectroscopy have been developed to predict ochratoxin A in contaminated wheat and fumonisins B1 in contaminated maize. Both quantitative and classification models were

developed to establish the most suitable approach to estimate these mycotoxin levels in samples. Several preprocessing of the raw spectral data, such as baseline correction, standard normal variate (SNV), mean centering, standardising, 1st and 2nd order derivatives and smoothing, were applied. Partial-Least Squares-Discriminant Analysis (PLS-DA) and Linear Discriminant Analysis (LDA) classification models were used to distinguish contaminated samples based on their mycotoxin levels.

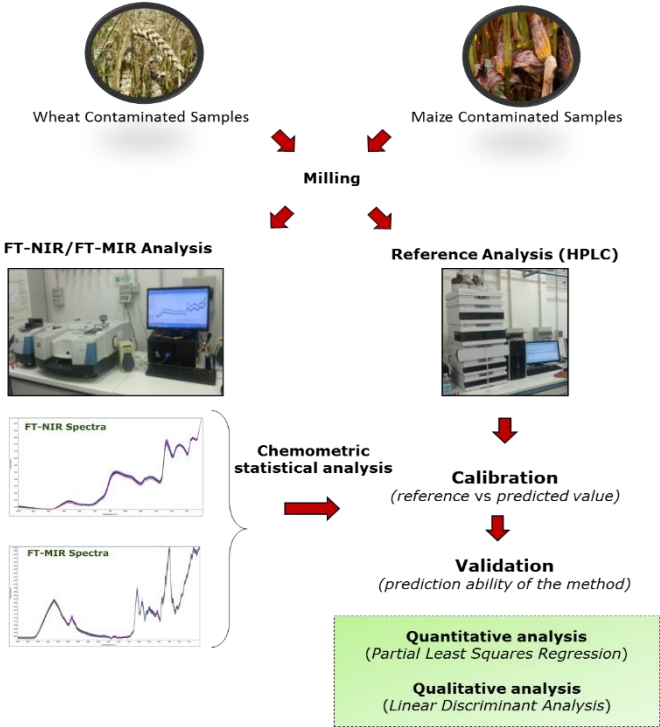


Figura 4.11: Experimental scheme

FT-IR spectroscopy is a promising, inexpensive and an easy-to-use screening tool to classify maize & wheat samples for mycotoxin content.

* Abstract of this work has been submitted to the "1st MycoKey International Conference" that will be held in September 2017, in Ghent University, Belgium.

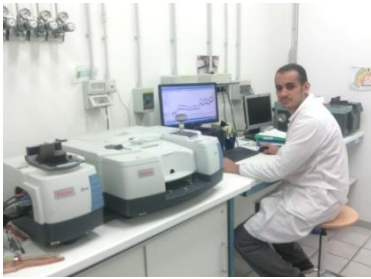


Figura 4.12: a)In Lab. during scan samples with FT-IR Spectroscopy and b) HPLC Analisis

Workshop:

Attending on 6th to 7th June 2017 "European Institutions and European research programmes and strategies". Rome, National Research Council of Italy (CNR-Italy).

How diplomazia2 can improve my future perspectives

In the recent decades, the world population's proportion engaged in agriculture has decreased and now 50 % of the global population lives in urban areas and by 2050 this population is expected to reach around 70 %. Due to rapid urbanization, there is a tremendous need for food security and extended food supply chains. For improving the efficiency of the food supply chains, governments should improve quality and quantity of food. Modern technology should play a vital role to supply humanity with healthy food. So, this program will help materialize my research vision for improving control systems of healthy food security. Therefore, it will help me in developing a high-tech system able to solve many problems of food investigation control in Egypt.



BIOSKETCH

My background and academic qualifications have been widely focused in the field of Soil sciences and environment. I am an engineer in crop system (expertise: Soil sciences and environment) from the National Agronomic Institute of Tunisia. I have a master's degree in Engineering of environment and management from National School of Engineers of Sfax (Tunisia). I obtained the International PhD in BioEcosystems and Biotechnology from the University of Studies of Basilicata (Italy) in March 2015.

Through my voluntary work with many associations and especially the Association that I founded “Jeune Science Kerkennah”, I have participated in community education programs to raise awareness of natural resources management and conservation in my island “Kerkennah”. I love photography, music, sports (football and swimming) and I like to travel and cultural exchanges.

Why I have applied for Diplomazia2 and expectations

I applied for this course mainly for two reason:

First, I obtained the International PhD in BioEcosystems and Biotechnology from the University of Studies of Basilicata, and I really enjoyed this experience, which allowed me to consider Italy as my second home country. Moreover, I have always had the desire to return to this country.

Secondly, within this PhD international program, I focused my studies on the management of soil organic matter and carbon storage in Mediterranean fruit orchards. I worked more specifically on the use of the electromagnetic induction as tool to support for CO₂ emission and soil carbon evaluation in an olive orchard grown under semi-arid conditions. I have studied the effects of soil management practices on Particulate Organic Matter (POM) fraction involved in soil fertility, the microbiological soil quality indicators in biodynamic and organic fruit orchards and finally the use of RothC model to Predict Soil Organic Carbon Stocks in Mediterranean fruit orchards. Therefore, the multi-disciplinary scientific education program “Science for

Diplomacy 2”, related to the development of sustainable agricultural and especially the second course “Management and Use of Agrofood Resources with the Aim of Fostering Sustainable Agriculture” corresponds exactly to my profile.

Having a good idea about CNR and its lines of research, my expectations were to integrate into a very interesting research project for my career, to work with a highly qualified team and to produce good results.

My experience as Diplomazia2 Fellow

activities report

I have been selected by CNR to participate in the multi-disciplinary scientific education program “Science for Diplomacy 2”, related to the development of sustainable agricultural issues. I have been accepted for the course 2 that focused on Management and Use of Agrofood Resources with the Aim of Fostering Sustainable Agriculture. During this program, I worked on the Exploitation of High Throughput Phenotyping by Imaging (HTP) for the investigation of plant stress responses to abiotic stresses related to climatic changes in horticultural crops using the Lemnatec (high-throughput phenotyping platforms).

The objective of this work was to learn about:

- the potential of non-invasive phenotyping technologies in the assessment of abiotic plant stress response,
- Planning of HTP experiments,
- Use of imaging and sensors to detect phenotypic proxies and markers of plant stress responses,
- Basic image analyses procedures.

This work was carried out within the Metapontum Agrobios: Agricultural Research and Experimental Station. This center is equipped with high-throughput phenotyping platforms. A key advance in high-throughput phenotyping platforms is the capability to non-destructively capture plant traits. This advance allows time-series measurements that are necessary to follow the progression of growth and stress on individual plants. Eliminating destructive measurements also increases the experimental capacity for genotypes, treatments, and biological replicates by reducing the required replicate sampling sets. ‘High-throughput’ is a classification that is relative to the effort associated with the measurement. Here high-throughput image-based phenotyping is defined as technology that can minimally image hundreds of plants per day.

In nature, water is usually the most limiting factor for plant growth. If plants do not receive adequate rainfall or irrigation, the resulting drought stress can reduce growth more than all other environmental stresses combined. Consequently, the sustainable use of water in agriculture has become a major concern. These conditions led us to exploit the High Throughput Phenotyping by Imaging (HTP) for the investigation of three varieties of tomatoes stress responses to water stress related to soil quality.

The first step concerns the sow of three varieties of greenhouse tomatoes (MoneyMaker, Ikram and Sitiens). Then, we analyzed two composite soil samples (sandy soil and clay soil) from the study site (Texture, Organic matter content and Electrical Conductivity) to determine and identify the water characteristics of these two soils.

The 28th of April, we made the first measurement with Leaf Porometer and the first lecture of our tomatoes plants with the HTP Lemnatec platforms as the initial state of our experimentation.

After this first lecture, we applied four irrigation treatment as follow:

- T1: 100 % of Wfc (Wfc: water content on field capacity)
- T2: 75 % of Wfc
- T3: 50 % of Wfc
- T4: 25 % of Wfc

We followed the water status of our plants regularly to maintain stable water conditions throughout the experiment period.

Five lectures with HTP were performed. Afterwards, a recovery was made on May 30th, to restore all the plants to the same water condition corresponding to 100% W_{FC}. Other two Lectures with HTP were held after the recovering.

Finally, the images taken during the experimentation for the four treatments by the different sensors, wavelength and modes, and from different views of the Lemnatec platforms, were analyzed to determine the effect of water stress and soil type on tomatoes plants.

My experience during Diplomazia2

I was very happy from the moment I received the letter confirming the awarding of the scholarship to participate in the program "Diplomazia2". Especially, when I learned that I would return to the Basilicata region, the region where I lived 4 years during the period of my doctorate.

It was a pleasure for me to be in a very well equipped research center. Metapontum Agrobios is a research centre devoted to research, development and technology transfer to agricultural and agroindustry system. The Metapontum Research Center owns and operates an automated plant

phenomics platform, the only currently present in Italy and among the few in Europe images (3D Scanalyzer System of Lemnatec).

On my arrival to Italy, the welcoming and logistical support that I received by administration personnel was excellent. I found the necessary support from the whole team and especially from Dr.ssa Maria Galitelli and Dr. Francesco Cellini and the role they played in ensuring good conditions, from document preparation (permit to stay, fiscal code procedures, Italian National Health Service registration, bank account opening), to accommodation, facilitated my integration into the working group.

I was very satisfied with my work during Diplomacy 2 and especially with a good supervision of Dr. Angelo Petrozza and all the team of Alsia Metapontum Agrobios. The professional support of professors and tutors was excellent compared to my expectation and needs.

The courses and the theoretical part of the program were also rich thanks to the good level and high quality of the professors. They responded to my education and training needs and have improved my knowledge.

The logistic support, the organization and the communication with CNR administration personnel and IVALSA, was excellent. Their help and their follow-up from the visa request to my arrival in Metaponto was very important.

Social sciences and humanities, cultural heritage



Figura 4.13: Pictures during Diplomazia2 activities

My experience in Italy

I have been in Italy for just a few years, but my experience here in Italy was a beautiful experience. I feel Italian, as I feel Tunisian. I am well liked by friends, and I have never had any problem of culture or religion and this is a pleasure to me.

The first impression of Italy was positive: I liked the orderly traffic, street cleanings, large green areas and Italian cuisine.

At first, I had some problems with the language and above all with the Southern dialect. Knowing French, I have been able to learn Italian quickly, now I have no difficulty in speaking. But when I talk, I always have to think about grammar, but I think I will be able to talk automatically over the time, because language fluency depends on practice and it takes time, too.

Italy for me is the land of nature. Natural parks with the pure beauty of all pollution makes me want to stay forever. The vegetation of Italy is extraordinarily varied and to discover it, is an unforgettable experience for me. The presence of mountain chains and extraordinary beaches can only give more beauty to the Italian landscape.

Roma, a wonder on earth, it is a historic city, everywhere I look, I see something extraordinary, monuments, historic palaces, walls, fountains ...

When I speak of Florence, I always describe it as an open-air museum. Venice the city that floats on water, unique in its charm. Milano, Napoli, Bari ... in every square meter of Italy there is something beautiful to see.

Bernalda, this small town, where people consider me a member of their families. They always invite me to go out, eat and I adore when they knock on the door on Sunday to offer me a typical Italian dish.

The Italian cuisine is inimitable and always uses fresh ingredients of good quality. Italy is a paradise for gourmets. Pasta, pizza, cheese, are the dishes I can never resist.



Figura 4.14: Pictures in Italy

How diplomazia2 can improve my future perspectives

Working with the National Research Council is an honor for a beginner researcher like me. Be integrated into a well-qualified professional team on the

Exploitation of High Throughput Phenotyping by Imaging (HTP) will teach me a new knowledge on a new topic for me. I was very lucky to work in the only research center that has a high-throughput phenotyping platform in Italy. During this program, I gained basic knowledge on the use of this platform and I learned a lot from the researchers working on it.

Diplomazia2, through theoretical and practical courses, helped me build professional relationships that can open up new opportunities and help me learn from experts who have years of experience in my research field. They provide great opportunities to introduce myself to important contacts.

My expectations are to obtain very interesting results, and to succeed in publishing the work in an important journal. My expectations also include to be able to use the knowledge acquired during this project in Tunisia even with simpler techniques, to create collaborations between the agronomic research institutes in Tunisia and CNR, IVALSÀ and AGROBIOS.

MARSELA LUARASI

Albania



BIOSKETCH

My background and academic qualifications have focused extensively in the field of agricultural economics, where I have gained an enormous amount of theoretical, empirical, and practical knowledge. My proficiency in this field opened the door to a postgraduate specialization opportunity in Montpellier, France, where agro-food market policy and public choice were the core issues of the program. At the time, I realized that to be recognized as a professional, I would first need to get a master's degree. I chose to deepen my studies in the organic agro-food market and organic agricultural regulations, concentrating in multiple aspects of sustainability where the economic, environmental, and social pillars merge. The master's degree in Bari, Italy offered me the chance to move towards an academic career as Senior Lecturer at the Agricultural University of Tirana in Albania, where I have been teaching economics related courses during the last seven years. For most academics, a doctoral degree is a mandatory requirement. I successfully completed my PhD studies at the University of Milan, in Italy, where my research work focused on agro-food standards in international trade flows, trade market theory, analytical and empirical analysis based approach.

I dedicate all my achievements to my mother!

Diplomazia2 Program and my expectations

I was interested in attending “Science for Diplomacy 2” program announced by the National Research Council of Italy (CNR), the leader public institution for scientific research in Italy and among the most important in Europe.

I applied to the second course “*Management and use of agro-food resources with the aim of fostering sustainable agriculture and arboriculture, as well as reducing physical and biological effects of climate changes*”, because I

found it very relevant to my background. Management and use of agro-food resources, sustainable agriculture, as well as climate changes are topics that I have been working on from an economic point of view. When I found out that I was accepted into the “Diplomazia2” program, I was tremendously honored.

Some of my expectations include gaining a great real working experience, making strong contributions to sustainable agriculture education through writing scientific articles and publishing the results, participating in different scientific activities, continuing in projects development and research, assisting in leading professional activities, and establishing future collaborations between CNR-IVALSA, ALSIA-AGROBIOS, and Agricultural University of Tirana (AUT) in Albania.

My experience at Diplomazia2 Program

Research activity

Based on the program’s requirements and following extensive discussions I had during the past few months with Dr. Francesco Cellini, Director of ALSIA-AGROBIOS, and Dr. Maria Gallitelli, the scientific coordinator, we decided to work on issues regarding to *Bio-economy in the Global and European context*. Bio-economy refers to the set of economic activities that use renewable biological resources to produce food, materials and energy through main sectors: *agro-food, marine bio-economy, forestry, and bio-based industry*. Those sectors on one hand are based on production from raw renewable resources, and on the other hand in the reuse and the recycling of bio-waste. In both cases, bio-economy needs an interaction and integration between sectors (public and private stakeholders, existing policies and strategies at International, European, national and even at regional level). The International, European and National Strategies of bio-economy are used to provide a shared vision of economic, social and environmental opportunities associated with more sustainable value chains. These strategies can represent significant opportunities not only for the EU countries (at country level) but also for the Mediterranean and for developing countries (at regional level) such as Albania, in order to enhance the competitiveness and to promote the important role of bio-economy for ensuring sustainability, economic growth and even political stability. However, a wide range of established and emerging policy, technology and market needs, experiences, and challenges are required to be shared in order to stimulate the integration.

Thus, in this context, based on “state of art” bio-economy, the objectives of this research work have been as follows:

Research objectives:

- Bio-economy in Italy
- Evaluation of the economic impact and performance of bio-economy in Italy (Review)
- Bio-economy in Albania: an overview of what Albania has to offer in the area of bio-economy, in order to have the opportunity to join BIC as Associate Member
- Identification of the available potential feedstock, initiatives, investments, established governmental policies and regulations on bio-based economy in Albania (state of art)
- Setting up a draft strategy implementation on bio-economy in Albania (at regional or country level)

Research work content:

- Bio-economy concepts and major pillars
- Research organizations engaged in “bio-economy related topics”
- Bio-economy in statistical data and available feedstocks
- European and National Strategies contents
- The importance of triple-helix clusters as soft governance systems in bio-economy
- The importance of Research and Innovation as a driver in bio-economy
- Sustainable use of genetic resources in bio-economy in the context of climatic change
- Importance of the bio-based industries at the regional level
- Financial incentives and collaborations

Since the concept of bio-based economy is a very new topic (almost unknown) in Albania, the research work identifies the potential bio-based resources of Albania. I hope that this will be a very helpful study for Albania, because bio-economy might contribute to the generation and to the sustainable economic development. For example, local biodiversity, sea resources, tourism, renewable energy production, marine aquaculture et cetera, are major local opportunities for economic growth and for creating employment opportunities. In addition, I am very optimistic that our final work product will be a very useful cooperation between Italy and Albania.

My experience during Diplomazia2 Program

The Diplomacy 2 program aims to establish continuous partnerships/relations between the Mediterranean countries on scientific grounds. The opportunity

to establish a collaboration with the Research Center of Agrobios located in Metaponto Italy, which owns the only technological platform on Phenotyping “*Lemnatec Scanalyser 3D System*”, in the Mediterranean area is a terrific opportunity and I took advantage of this chance. Working and studying at this research center is a tremendous asset also for the Agricultural University of Tirana, in Albania. Furthermore, working at ALSIA- AGROBIOS, has been a very rewarding experience. The colleagues have been friendly, cooperative, and responsive towards everything. I have nothing but good words for our scientific coordinators Dr. Maria Gallitelli and Dr. Francesco Cellini who have been extremely helpful in coordinating our project. I am personally very satisfied with my work project, which is proving to be very relevant to my field of interest.

I am also tremendously honored that I attended “Horizon 2020” meeting on the *European Research Programs and Strategies* held at the National Research Council in Rome, to learn about EU funded research and innovation projects, as well as emerging opportunities for further collaborations between our countries.

My experience in Italy

My previous experiences in Italy have been nothing but the best.

Thanks to the generosity of the Italian government, I was able to attend the Master of Science studies at the International Center for Advanced Mediterranean Agronomic Studies in Bari, and the PhD program at the University of Milan on a fully funded scholarship. My qualifications and working experience in Italy at both the Master and PhD levels have helped me to develop skills that are very useful in any research setting. Working with data, analyzing economic phenomena and writing articles have taught me to research extensively, analyze my findings and communicate my conclusions clearly. In this context, I have gained a huge experience on how I can put my academic knowledge into practice.

The International Center for Advanced Mediterranean Agronomic Studies in Bari is a Mediterranean intergovernmental organization devoted to the promotion of multilateral cooperation through specialized network research, scientific diplomacy and political partnerships. Bari city is the second most important economic center of Southern Italy, well known as a university city.

University of Milan is a top Italian university in most international rankings, in terms of scientific research productivity and its relationships with the business world as an important source of its socio-economic contents. It has been an honor for me to attend my PhD studies in Milan, one of the most

dynamic areas in the European Union, the leading city in Italy for investments in technological research & innovation and one of the most famous cities for fashion in the world.

During my PhD studies in Italy, a European country with a powerful mark on ancient culture, I had also the opportunity to learn about the great art, the ancient culture and history, the well-known architectural and incredible sights of one of the most beautiful countries in the world.

In addition, thanks to the wide range of its territory and the long and diversified historical heritage, Italy enjoys a unique variety and richness in the food traditions. This is considered one of the most important distinguishing features of Italy and one of the main strengths in international competition on food markets. Italian food is one of the few global cuisines that I love, due to its great assortment of different ingredients used with very particular and delicious combinations. I enjoy it very much.

I have nothing but continued respect for Italy and Italians.

Future perspectives through Diplomazia2 Program

I am very grateful to the National Research Council of Italy, to Dr. Mauro Centritto, Director of IVALSA Institute with the Headquarters in Firenze, and to Dr. Domenico Pignone, the scientific coordinator of the project, who gave me this priceless opportunity to participate in such a pragmatic scientific program, and to improve my knowledge through the multitude of courses and exchange research experiences between Italy and Albania.

I am also very grateful to Prof. Dr. Bahri Musabelliu, Rector of Agricultural University of Tirana in Albania, and to the other directors who encouraged me to attend “Diplomazia2” program.

During “Diplomazia2” program, I had also the opportunity to meet and work alongside many experts from IVALSA, Institute of Firenze, with a common interest on research, which would be a valuable prestige for my future career.

I hope that this partnership will create fruitful future multilateral collaborations and knowledge sharing between our institutions, CNR-IVALSA-Agrobios in Italy and the Agricultural University of Tirana, in Albania.



BIOSKETCH

I got my B.Sc. in Horticulture, Faculty of Agriculture, Cairo University and I also obtained my M.Sc. and my Ph.D. from the Faculty of Agriculture, Cairo University. My M.Sc. in Agriculture Sciences, Biotechnology, Vegetable crops Department, in Biotechnology field. Diploma in Advanced Studies in Sustainable Agriculture. CIHEAM, -June 2009, Bari, Italy. Ph.D. in Agriculture Sciences, Organic and Biofertilization, Vegetable Crops Department. I'm working as a Researcher, Department of Potato and Vegetative Vegetable crops, Agricultural Research Center(ARC), Horticultural Research Institute, Giza- Egypt. My research work area : Organic and Bio fertilizer, Green house, Crops Production and Biotechnology. Research Projects Participations:1- The development of post-harvest treatments of some vegetable crops Project,2- An increasing the export competitiveness of some vegetable crops Project,3- Bio and Organic Potato Production Project and 4-Plant Biotechnology Searching Project(funded by EU) Cairo University, Faculty of Agriculture, Vegetable Crops Department.

Why I have applied for Diplomazia2 and expectations

I applied for this program “ Science for Diplomazia2 “ for many reasons :

1. It is very close to my work area and my pervious study: M.Sc. , Sustainable Agriculture Diploma and Ph.D. My work in M.Sc. was about using Biotechnology technique to produce a new type of resistant potato to “Late Blight Diesis”. After I got my M.Sc. I had the great chance to study Sustainable Agriculture in Mediterranean area for one year in Italy “Diploma” at the International Center for Advanced Mediterranean Agronomic Studies “CIHEAM” and we published a case study during this year. My Ph.D. work area was using : Nitrogen Fixation Bacteria and Compost Levels to enhancement Potato Production Under Newly Reclaimed Sandy Soil Conditions in Egypt , and during this study I had again another great chance to participate and published a paper on a Conference held in Ancona, Italy, and I really enjoyed my experience in

Italy which allowed me to acquire a wide range of knowledge and communication. That is why I consider Italy my Second home-country and always like to return to Italy.

2. I have a very good opinion of CNR and its Research plan and multidisciplinary activities, and I like to participate in these activities with the aim to strengthen the dialogue and cooperation between researchers from other countries through science and research.
3. The multidisciplinary scientific program “Science for Diplomacy 2” especially course 2 “Management and use of food resources aimed at the sustainability of agriculture and forestry, and the mitigation of the physical and biological impacts of climate change“ is exactly related to my previous studies and my present work.

My expectations: transfer of technology; solutions to improve the production processes in Agricultural sector in Egypt and to work with the new challenge “Climatic Changes”. A future cooperation between Agricultural Research Center, Egypt and CNR, Italy through Research projects which can be funded from Academy of Scientific Research and Technology (STDF projects) or from EU.

My experience as Diplomazia2 Fellow

Activities report

During this program I worked on the ”Use of abiotic plant stress response genes via molecular breeding to improve tomato resilience to abiotic stresses related to climatic change” the objective of this work is to learn about:

- the relevance of Heat Shock Factors (HSF) and polyamines in plant abiotic stress response
- modulation of plant stress response to abiotic stresses via molecular breeding
- use of HTP imaging to detect phenotypic traits during stress
- Basic image analyses procedures

This work was carried out in Metapontum Agrobios: Agriculture Research and Experimental Station, Metapontum Agrobios is an extraordinary Center: very dynamic and well-equipped,.

Current agricultural production is very dependent on large amounts of inputs, and water availability is a major limiting factor. In addition, the loss of genetic diversity and the threat of climate change make necessary a change of

paradigm in plant breeding and agricultural practices. Average yields in all major crops are only a small fraction of potential yields, and drought and soil salinity are the main factors responsible for yield reduction. Both genomics and phenomics will assist the investigation of genetic variation in crops landrace germplasm and in crop wild relatives. Novel genetic variation will be needed to extend the range of tolerances to high temperature stresses and to severe droughts in the crop growing period that are predicted to be extreme with climate change. Therefore, there is a need to enhance crop adaption to climatic changes by improving crop resilience and productivity. The development of crops tolerant to drought, heat and salt stress for addressing the challenge of climatic change and increasing food production in the near future represent an important target for breeders. It is also important the role of biodiversity, which provides a number of natural services: genetic diversity; Protection of water resources, Soils formation and protection, Nutrient storage and recycling and Contribution to climate stability.

ACTIVITIES

Evaluate:

- Preparation of ADC₁ and ADC₂ over expressing tomato plants for abiotic tolerance.
- Plant Screening (PCR & RTPCR)
- Phenotypic Drought stress evaluation by High- Throughput Phenotyping Platform

Obtainment of TRANS tomato Expression HSF or HSP in pollen

- Cloning
- Plant transformation
- Plant screening (PCR & RTPCR)

Metapontum Agrobios : Agriculture Research and Experimental Station is equipped with high-throughput Phenotyping platform which is the capability to non-destructively capture plant traits. This advance allows time-series measurements that are necessary to follow the progression of growth and stress on individual plants. Plant's stress and phenotypic responses were assessed by using an automatic plant phenotyping platform with image capture and processing technologies that combine quantification of growth and phenotyping with high reproducibility, allowing long term data storage for data mining. The system consists of three parts: a conveyor unit, an imaging unit with three imaging modes, RGB (visible), UV (ultra violet), NIR (near infra-red) cameras and software

to analyses morphometric parameters. RGB imaging was used to analyses tomato plants in dimension, height, colors component and compactness measurements. UV imaging to evaluate photosynthetic efficiency of plants.

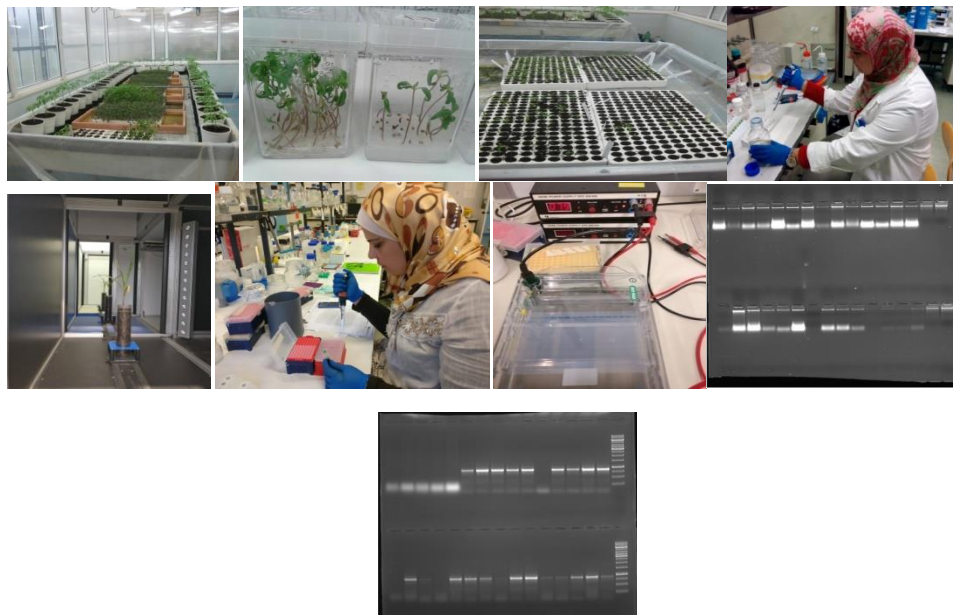


Figura 4.15: Diplomazia2 activities

My experience during Diplomazia2

I was very happy when I received the confirmation mail that I was awarded a fellowship within this program and it is always a pleasure for me to return to Italy.

From the first day I arrived to Metapontum Agrobios everything was clear and done on time, Agrobios staff was very collaborative and always ready to help and answer any question, actually I am a lucky researcher to be here and to work with a very good scientist like my scientific tutor: Dr. Rina Iannacone. In fact from the first moment I arrived, I found all the help I needed from all the team, especially from Dr. Maria Galitelli and Dr. Francesco Cellini and all their efforts were made to ensure very good conditions for my work and stay, also for all the procedures related to administrative duties and accommodation, giving me all available facilities in Agrobios, solving any problem immediately, giving me a lot of chances to attend workshops and conferences, supporting my applications for other scholarships or training programs.

For my work during Diplomazia2: I am really very lucky to have a scientific tutor like Dr. Rina IANNACONE, she is a very good scientist, always supporting me, from the first working day she taught me all the new techniques, always supporting my requests to attend workshops and conferences and helped me a lot in this. Also she helped me a lot to improve my career. I hope one day to be like her, and from the social point of view, she was very nice, participating with me in wonderful social events which I will never forget.

For the theoretical part of the courses: actually it was more than perfect, very close to my work interests and career, I learned new subjects, opening a new way of thinking and giving me a lot of ideas to be deepened in the future.

Deeply grateful to Dr. Mauro Centritto Director of IVALSA for all he did for me as of the beginning, for addressing me to Agrobios, teaching lessons which are very important and very close to my profile, helping me in a lot of things and welcoming future collaborations.

My Diplomazia2 colleagues here in Metapontum Agrobios are so friendly, cooperative and caring, special thanks to all of them.

Thanks to Dr. Angelo Petrozza for assisting and helping to use and work with Throughput Phenotyping Platform part.

Thanks to Dr. Domenico Pignone for all his efforts during this program.

My experience in Italy

I have been 2 times before in Italy and my first travelling and learning abroad experience was here in Italy considered one of the most beautiful countries in the world which has wide range of culture, arts, wonderful natural views, very kind people and warm feelings.

I really like this country very much. Italian people are so kind and have warm feelings, also caring about foreign people; actually I didn't feel that I am outside my country. When I am here I feel like I am in my country and I always have family here. For these reasons, I always like to be here and I consider Italy my second home country. I visited a lot of places here to see different kind of arts and culture, and I have a lot of Italian friends around Italy. The closest city to my heart is Roma which I visited more than 5 times and if I have the chance I will visit it again and again. I also visited a lot of beautiful cities in Italy from the South to the North.

Recently, I had a new friend from Matera called Marizza and I invited her to visit Egypt and stay with me, she will go to Egypt on Christmas Holidays this

year, really it is amazing to have friends from different countries. It is a big chance for cultural exchanges.

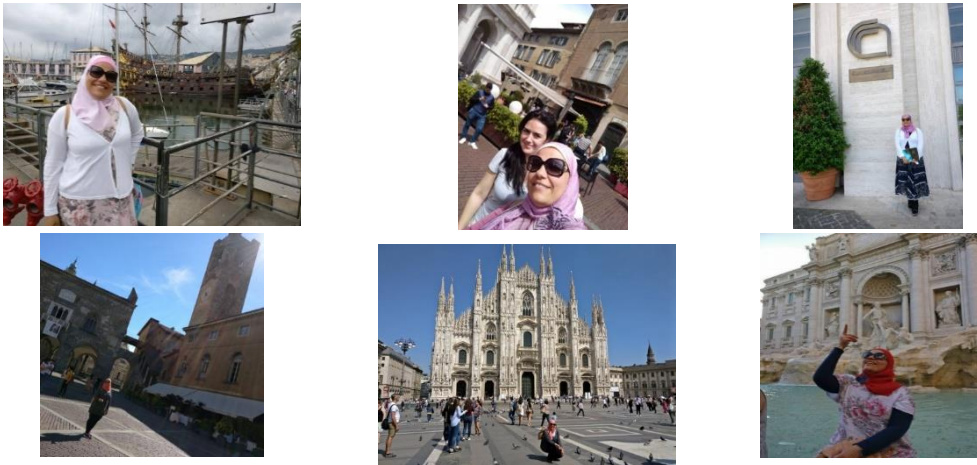


Figura 4.16: my experience in Italy

How diplomazia2 can improve my future perspectives

According to what I gained from this program I can say that CNR helped me a lot by giving me this chance to improve my career and increase my knowledge also my communication network, via participating in different scientific issues and attending training days :Meeting on European Research Programs and Strategies at National Research Council of Italy 6-7 Jun 2017, Roma.

Also I consider myself very lucky to be: In Metapontum Agrobios which is a very good facility.

Also CNR opened the door for further future collaboration between my institute in Egypt and IVALSA, Agrobios and CNR.

Again special thanks to Dr. Mauro Centritto Director of IVALSA for welcoming a future collaboration and encouraging me always through a strong support.

Special thanks to Dr. Maria Galitelli, Dr. Rina Iannacone and Dr. Francesco Cellini Director of Metapontum Agrobios for their welcoming a future collaboration and for encouraging and supporting me all the time.

4.3 Tutors and Lecturers

MAURIZIO BACCI

CNR – IBIMET, Lecturer



BIOSKETCH

Agro-meteorologist. Researcher at Institute of Biometeorology (CNR)

Expert in climate change impact assessment, GIS and Remote sensing and information management, Capacity building and training activities with more than 15 years of work experience in Sub-Saharan Africa.

Abstract

Climate Change and Agriculture in the Mediterranean.

In the last decades, the scientific community agreed to consider the Mediterranean basin one of the most vulnerable regions in the world due to the impacts of CC interrelated consequences, its precarious socio-economical conditions, and its fragile political systems. Several studies underline that climate change is often combined with socioeconomic elements, such as agriculture or energy, in a relationship of mutual influence. Therefore, a loss of agricultural productivity may accelerate the rural exodus posing serious problems in the major urban centers and in neighborhood countries.

The lesson highlights the last Climate Simulation, Projection and Prediction for the Region and it gives some basic knowledge elements about the physics processes that drives these changes. In the lesson we underline some specific concepts that better illustrate climate prediction such as the predictability and the management of the error.

The lesson has given also a brief overview on Climate Change Impacts on agriculture and the related Risk Management. So basically we introduce the agrometeorology as the science that study the interaction of meteorological and hydrological factors with agriculture. Its objectives are to elucidate these effects and to assist farmers in preparing themselves by applying this supportive knowledge and information in agrometeorological practices and through agrometeorological services. In the lesson we introduce the techniques to evaluate the effects of Climate Change on crops productivity such

as the crop simulation models and how to use these results in the climate change adaptation process.

In synthesis the lesson want to increase the likelihood of public actions in climate change adaptation in agriculture that are better grounded in scientific knowledge and customized for the local context.

MARINA BALDI

CNR – IBIMET, Lecturer



BIOSKETCH

Research Scientist at CNR (1988 – present)
Director of WMO Regional Training Center in Florence (2014 – present)
Responsible of the IBIMET-CNR branch in Roma (2006 – present)

Education: Physics Degree at the Univ of Rome (1985),
Geophysics specialization – Univ of Rome (1984)
Specialization in “Atmospheric Air Pollution Modelling”
ICTP – Trieste (1989) EMS training courses on
Communication skills for climatologists and WMO
training courses

Research focuses: Climate variability and impacts on the
biosphere and water resources, Climate extremes,
Interaction between land use and land use change and
climate

Publication record (updated June 2017): 33 ISI papers;
H-index: 12.

Web pages: <http://www.fi.ibimet.cnr.it/staff/baldi-marina>

<http://www.researcherid.com/rid/C-5134-2009>

<http://scholar.google.com/citations?user=hw5dwXsAAA&hl=en>

Abstract

Climate change and variability and climate extremes in the Mediterranean with a focus on African Countries; Sources of climate data and information.

Following IPCC 2001, 2007, 2013 an extreme weather event is an event that is rare within its statistical reference distribution at a particular place. Definitions of “rare” vary, but an extreme weather event would normally be as rare or rarer than the 10th or 90th percentile. By definition, the characteristics

of what is called extreme weather may vary from place to place. An extreme climate event is an average of a number of weather events over a certain period of time, an average which itself is extreme. Changes in extreme weather and climate events are among the most serious challenges to society in coping with a changing climate (CCSP, 2008). These events have significant and severe impacts on our society and environment: heat waves and floods can be devastating for human health; extremes as drought, storms and flooding can impact agriculture, ecosystems, energy, tourism, and all have major economic implications. Indeed "confidence has increased that some extremes will become more frequent, widespread and intense during the 21st century" (IPCC, 2013). As a result, the demand for information services on extremes is growing, and the sustainability of economic development and living conditions depends on our ability to manage the risks associated. Is therefore necessary increase our knowledge about those events and their changes and variability.

In the first lecture trainer focused on the definition, and then on the detection and attribution of climate extremes, on their changes in the last decades, and presents the guidelines for the analysis of extremes in a changing climate. In the second lecture, trainer focused on the importance, for detection and attribution studies, of reliable sources of climate data (time series, model results, and future scenarios), on their (public) availability, on the issues connected (quality control of data, homogenization, downscaling, etc) and on tools freely available for their analysis.

GIULIO BETTI

CNR – IBIMET, Lecturer



BIOSKETCH

Meteorologist since 2002 and climatologist since 2007 for private and public companies. Currently my main activities are: weather forecasts (marine and terrestrial), weather broadcasting (TV-Radio) and scientific research.

My weather forecast activity is devoted to: Civil Defence support and Broadcast Contents. I have been part to the Costa Concordia wreck removal project providing daily on-site marine weather forecasts (between November 2012 to March 2014).

My research activity is devoted to Seasonal Forecast, dynamic climatology (teleconnection patterns, climate indices) heat stress (thermal indices such as THI and Humidex) and the relationship between air pollution and meteorology.

	I do also teaching activities for schools, institutions and professionals.
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Abstract

Seasonal weather forecasts and teleconnection patterns.

Providing seasonal weather forecasts outlook through analysis of climate indices and teleconnection patterns. Description and definition of the prominent teleconnection patterns and climate indices that have a relevant role in changing weather circulation over Europe, Middle East, Northern Africa and Balkans. A brief analysis of the relationship between climate indices and teleconnection patterns. Description of “qualitative” seasonal forecast outlook chain: from the detailed analysis, monitoring and forecast of selected climate indices to the forecast of most likely synoptic configurations expected. Some useful case studies shown.

TIZIANA DE FILIPPIS

CNR – IBIMET, Lecturer

	<p>Tiziana De Filippis, PhD, permanent researcher at CNR-IBIMET. Her main research interests are focused on Geomatics & ICT for sustainable development and in integration of multi-source data for environmental analysis for regional studies.</p> <p>She has a long-standing experience in the coordination of research projects on SDI (Spatial Data Infrastructure) and natural risk management. She is responsible for designing and implementing of WebGIS and mobile applications, GeoDB specifications, customized stand-alone sw GIS Open Source, Geoportals and DSS in national and international projects. Author of software user’s manuals, training manuals and project technical reports.</p> <p>She has been scientific and technical coordinator of customized GIS developments and user-friendly software for monitoring agricultural season to support the meteorological and early warning national services for food security in sub-Saharan countries. She has been National delegate of EU COST Action719 “GIS applications in meteorology and climatology”, WMO GIS</p>
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	<p>Consultant in LDCs, Scientific coordinator and instructor of IBIMET training programmes for WMO - Regional Meteorological Training Centre, World Bank, FAO and EU Summer School COST719. She is currently Project Manager of CNR-IBIMET SensorWeb Hub infrastructure.</p>
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Abstract

Open source geoprocessing tools and meteorological satellite data for crop risk zones monitoring in sub-Saharan Africa

Agro-geoinformation is the key information in the agricultural decision making and policy formulation process, specially in the countries where food security mainly depends on rain-fed crops production. It’s the case of Sudano-Sahel zone where scarce economic resources hamper regular monitoring of crops development; a context that requires new approaches to detect crops risk zones during the agricultural season. The advances of Earth observing and sensing technologies, as well as geoprocessing web tools, enable new opportunities and challenges in applying agro-geoinformation to crop monitoring and assessment. The lesson has introduced the “4Crop” web application, an open source and interoperable solution to meet the needs for a long-term sustainability of operational tools for drought risk identification and forecasting in the Sahelian countries that balances the lack of sufficient and timely acquisition of ground data using meteorological satellite open data sets. The web geoprocessing provides architecture, standards and tools to combine conventional analysis functions, advanced computing technologies, specific methodologies and online community collaborations. The 4Crop client/server architecture has been implemented using open source tools and standards in order to guarantee the web application sustainability and the implementation of customized geospatial functions required by the end users. The 4Crop (<http://149.139.16.22:8080/4crop-1>), running at present on Niger and Mali, has been implemented using PL/pgSQL & PostGIS functions to process different satellite meteorological data sets. The fundamental idea is to automate geospatial analysis of a soil water balance by using multiple steps procedures implemented into the internal GeoDataBase (GeoDB). The 4Crop outputs aim to identify installation and phenological phases of the main rain-fed crops (millet, sorghum, groundnut, cowpea) and to create crop risk zones images for each country selected. The 4Crop allows Meteorological Services to evaluate the crops growth conditions on the basis of the level of satisfaction of water requirements, highlighting the areas where significant water stress have repeatedly occurred. In conclusion the web geoprocessing is changing the way in which agro-geoinformation applications and systems are designed,

developed and deployed. It facilitates distributed geospatial computation and large networks of collaboration. Moreover, the approach presented is meant to encourage the integration and sharing of interoperable and open source solutions and thus contribute to the setting-up of distributed climate services in developing countries.

ROBERTO FERRISE

CNR – IBIMET, Lecturer



BIOSKETCH

Roberto Ferrise is researcher at the Department of Agri-food Production and Environmental Sciences - University of Florence (DISPAA - UNIFI). He was graduated with honours in Agricultural Sciences (University of Florence) in 2005. In 2010 he discussed the PhD thesis on “Climate change risk assessment for durum wheat” at the University of Sassari.

His main research activities concern agrometeorology, ecophysiology and crop modelling with a specific focus on the assessment of the impact of climate change on typical Mediterranean crops (i.e. durum wheat, grapevine, olive) and the investigation of possible adaptation and mitigation strategies to cope with. He worked on the coupling of crop simulation models with medium-term weather forecasts (1-6 months) for the application in precision agriculture. He is currently working on the identification of working adaptation strategies and related uncertainties for durum wheat in the Mediterranean by using multi-model ensembles and climate probabilistic projections. Further interests are the use of crop modelling for designing future climate resilient crops as an adaptation measure as well as improving crop simulation models by incorporating the effects of pests and diseases.

Abstract

The course “*Crops modeling, theory and application in the framework of climate change in the Mediterranean basin*” was aimed at introducing the use of crop models as a tool for assessing the impact of climate change on crop phenology and yield. To this, a preliminary introduction to concepts and definitions of modelling as well as the classification of the main typologies of crop models, their weakness and strength are provided. Then, the most widely

crop processes considered in crop modelling are described and analysed together with a brief summary of the most used methodologies for evaluating models. Finally, the methodology for coupling crop simulation models and climate models in a climate change impact analyses is described. A couple of impact assessment studies performed in the Mediterranean Basin are reported as example.

EDOARDO FIORILLO

CNR – IBIMET, Lecturer



BIOSKETCH

After a degree in Agricultural Sciences, Edoardo Fiorillo attended a Master Course in “Geomatics and Natural Resources Evaluation”. Since 2007 he works at IBIMET and his research interests are: precision agriculture; climate change and agriculture; land-use management and planning; environmental impact assessment; Earth observation and satellite image analysis.

Abstract

Short course in Geographical Information Systems (GIS) and Remote Sensing (RS).

Knowledge of Geographic Information Systems (GIS) and Remote Sensing (RS) is an increasingly sought after skill in research activities. The course offers a scientific foundation in spatial data modelling, analysis, and visualization. The participant learns how to analyse spatial data, use cartography techniques to communicate results in maps, and collaborate with peers in GIS and GIS-dependent fields. The lessons: i) go in-depth with common data types (such as raster and vector data), structures, quality and storage; ii) teach fundamentals about remotely sensed and satellite imagery and introduce to the electromagnetic spectrum; iii) explain how to find and download satellite imagery online and use it for two common types of analysis: NDVI and trained classification; iiiii) go in-depth on projections and coordinate systems, which are foundational to all GIS; iv) teach how to use and create digital elevation models (DEM) and related products (hillshade, slope); v) show how to use ModelBuilder to create large processing workflows that use parameters, preconditions, variables; vi) give fundamentals about using GPS (Global Positioning System) and importing data in GIS environment. During the last lessons, a case study will be developed aimed to specific research purposes.

BENIAMINO GIOLI

CNR – IBIMET, Lecturer



BIOSKETCH

His scientific interests are on development of tools and methodologies related to surface exchange measurement between the biosphere and the atmosphere at the regional scale; development of the SkyArrow ERA platform. Expert in micrometeorology and eddy covariance applied to ecosystems and urban environments, including non CO₂ species (VOC, N₂O, O₃; CH₄). Expert in remote sensing and its application for biosphere studies, including the ESA-FLEX initiative.

Abstract

Methodologies and global networks of ecosystem greenhouse gas exchange measurements.

This contribute illustrated was organized in the following sections:

- **Biogeochemical cycles and their measurement:** we learned the importance of the carbon cycle toward climate, and the role of the biosphere, and particularly ecosystems, in regulating the exchange of greenhouse gases and therefore exerting a positive or negative impact on the climate system. We learned how surface exchange of compounds, either greenhouse gases and other species, can be monitored with micrometeorological techniques, specifically the *eddy covariance* method. Eddy covariance is a technique capable of measuring surface net exchange at half-hourly temporal resolution, of any compound provided that fast response for that compound are available. The main up to date measurement techniques, including cavity ring down spectroscopy (CRDS), have been illustrated.
- **International networks:** measurements that initially started at single site level are today organized in networks of stations, at regional, national and international level, such as FluxNet (www.fluxdata.org). At european level, the Integrated Carbon Observation System (ICOS) is a pan-European research infrastructure which provides harmonised and high-precision scientific data on carbon cycle and greenhouse gas budget and perturbations (www.icos-ri.eu).

- **Case studies:** Some relevant scientific case studies have been illustrated, based on measurements made with the eddy covariance technique in different environments, ranging from terrestrial ecosystems, to urban areas, to marine ecosystems. Applications of this technique to non-CO₂ species, including Biogenic Volatile Organic Compounds (BVOC) was finally illustrated.

RAMONA MAGNO

CNR – IBIMET, Lecturer



BIOSKETCH

- Studies on extreme climatic events, with a focus on drought and its impacts on natural and agriculture environments. Expert on drought monitoring through the integration of satellite-based and ground-based indices.
- Collaboration on the implementation of the Ibimet Climate Services: responsible of the drought monitoring and forecasting system.
- Climatologic studies related to climate change at different scales (from local to global).
- Studies of energy and mass (CO₂, H₂O) fluxes from vegetation using Eddy Covariance technique and interaction with anthropogenic greenhouse gases emissions (Osservatorio Kyoto and Focal Point Kyoto projects).
- Models for the identification of sensitive areas to desertification (DISMED and DesertNet projects).
- Photointerpretation of aerial and satellite images for the Tuscany land cover update.
- Teaching activities both for teachers and students (from elementary to university) on climate change and its impacts.
- High-level WMO (World Meteorological Organization) training courses for technicians of different countries (from Africa to Europe), on climate change and drought monitoring and forecasting techniques to mitigate its impacts on water resources.

Passions, hobbies and sports: bricolage; photography; choir singing; role playing, judo, running, travelling.

Abstract

Drought monitoring and forecasting system: from daily to seasonal scale.

Drought is a creeping and complex phenomenon, characterized by a slow and often long-lasting evolution and the impacts produced on the environment can arise later and persist even after its end.

A lack of precipitation over long periods, especially during the wet season and consequent lowers groundwater levels, may have strong environmental and societal impacts, increasing pressure on water resources an putting agriculture, and above all rainfed crops, at risk.

The Mediterranean Basin and Africa are considered to be a hot spot subjected to strong warming and drying, with increasing consequences on drought occurrence and severity.

For these reasons a comprehensive framework including a climate-based, satellite-derived monitoring and a seasonal weather forecast is the most reliable way to identify drought occurrence and trends and to deliver timely information for impact reduction. During the lesson, a proactive, integrated drought monitoring and seasonal forecasting tool was briefly illustrated, with the aim to supply an example for filling the temporal gap between the development of a dry period and the response of final users in managing drought-related emergencies, by delivering maps and information in quasi-real-time.

The lesson was organized in six sections: 1.Drought definition and its characteristics; 2. Drought impacts; 3. Coping drought; 4. Drought indices; 5. A regional system example; 6. The integration of information.

ALESSANDRO MATESE

CNR – IBIMET, Lecturer



BIOSKETCH (in English)

Researcher at National Research Council - Institute of Biometeorology (CNR-IBIMET), Italy (2004-Current). Degree in Natural Sciences at Florence University (Italy), Department of geomorphology (1994).

PhD in Agriculture, Forest and Food Science, Doctoral School of Sciences and Innovative Technologies, Torino University (Italy).

Scientific background in precision agriculture and analysis of remotely sensed imagery captured by UAS (Unmanned Aerial Systems). Management zones delineation by multi-temporal remote sensing by UAS. Timely detection and spatialization of NDVI

	by using multispectral imaging sensors and UAS. Estimation of crop quality parameters by remote sensing
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Abstract

Precision Agriculture Tools.

Precision agriculture aims to maximize the oenological potential of vineyards. This is especially true in regions where the high quality standards of wine production justify the adoption of site-specific management practices to simultaneously increase both quality and yield. Spatial variability within fields has been widely demonstrated by soil and crop yield differences. Assessing variability is the first critical step and a necessary condition in precision agriculture, since it is clear that one cannot manage what one does not know. Precision agriculture thus seeks to exploit the widest range of available observations to describe the vineyard spatial variability with high resolution, and provide recommendations to improve management efficiency in terms of quality, production, and sustainability.

The introduction of new technologies for supporting vineyard management allows the efficiency and quality of production to be improved and reduces the environmental impact. Remote and proximal sensing sensors become strong investigation instruments of the vineyard status, such as water and nutrient availability, plant health and pathogen attacks, or soil conditions.

Technological development in the field of automation has provided precision agriculture with a new solution for remote monitoring, UAVs. These platforms can be equipped with a series of sensors, which allow a wide range of monitoring operations to be performed. The peculiarity of UAV application in remote sensing is the high spatial ground resolution and the possibility of highly flexible and timely monitoring, due to reduced planning time.

Within proximal sensing applications, there are many tools available for continuous measurements such as Wireless Sensor Network (WSN) technologies, providing a useful and efficient tool for remote and real-time monitoring of variables involved in grape production, processing the data and transmitting the required information to the farmers. The primary application of WSNs is the acquisition of micrometeorological parameters at vine canopy and soil level. In the last decade, the continuous innovation process has allowed the development of new kinds of systems for plant physiology monitoring based on low cost and open source devices.

MASSIMILIANO PASQUI

CNR – IBIMET, Lecturer



BIOSKETCH

He was born in Rome on July 5, 1971, he graduated in physics at Tor Vergata University in Rome and obtained a PhD in Physical Modeling for Environmental Protection at the Department of Earth Science at the University of Bologna. In March 1998 he began collaborating with the Meteorology and Environmental Modeling Laboratory (LaMMA), dealing with numerical modeling in support of weather forecasts, and participating in a number of national and international projects in this field. Since 2002, he has been a researcher at the CNR-IBIMET of the National Research Council (CNR) and is conducting research in the field of seasonal forecasts, construction of future climate scenarios and their impact on agriculture.

In the last decade he has been engaged as a contract professor in meteorology, numerical modeling and climatology courses at several Italian universities, as well as in post-lauream master classes organized by national and international research organizations.

He is author of numerous scientific articles on international journals and dissemination articles on atmospheric science and climate change in the Mediterranean basin and Africa.

Abstract

Seasonal forecast in the Mediterranean Basin.

In the last decade seasonal forecasting systems of climate variability have received an increasing attention since their potential role in decision-making processes in a large spectrum of human activities. In this lecture an overview of main seasonal forecasting approaches is provided along with main critical aspects and example of applications both for water management and agriculture productions. In particular a description of seasonal forecast modelling characteristic, downscaling technique and forecast performances were provided.

FEDERICA ROSSI

CNR – IBIMET, Lecturer



BIOSKETCH

“Being a researcher is a hard job, but you need to be a 360° person and not only a scientist.” This is what I try to follow daily. I studied Agricultural Science at the University of Bologna and then dedicated my career to understand plants and their relations with environment, weather and climate, a field that I know to have a big impact on people’s lives.

I am Senior Researcher at the CNR Institute of Biometeorology (IBIMET) in Bologna, and full professor in Science and Technology of agricultural and forest systems. I have been serving as Vice-President of WMO Commission for Agricultural Meteorology (CAgM) since 2010. I am representative of Italy at International Society Horticultural Science; and I have represented my Country on the MCs of Cost Actions 734 “Impacts of Climate Change and Variability on European Agriculture” and 187 “Meteorological Applications in Agriculture”. I am founding Member of the International Society of Agrometeorology, President of the Global Federation of Agrometeorological Societies, member of the Council of Accademia dei Georgofili, and nominated Academic of Accademia dell’Agricoltura. I trust on the need to bring technological innovation to agriculture, so I offered myself as representative at the Agroindustria Custer 4.0. Technological applications, I acted as Vice-Director of the Fabbrica del Futuro; and I am the President of the Scientific Council of Technological Consortium Proambiente. I have been elected in the SC of the Climate Smart Agriculture Booster, Climate Kic. I like traveling, gym exercises and modern art. I believe that success takes dedication and bit of fantasy, and that it is a commitment to all of us to dedicate time to others and to support the people working with us. “Do not be afraid to fight for your ideas, but respect the ideas of others.”

Abstract

Climate Smart Agriculture

Reshaping agriculture towards a climate smart attitude is now a must. Such Climate Smart Agriculture (CSA) approach is aimed to develop strategies to secure sustainable food security under climate change and variability. CSA is one of the 11 Corporate Areas for Resource Mobilization under the FAO’s Strategic Objectives, it is in line with vision for Sustainable Food and Agriculture and supports the Sustainable Development Goals. The lesson was about driving students attention to the ways to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. The three main objectives of CSA we explained, providing a vision about sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible. Students were also informed about the Climate Kic Flagship project Climate Smart Agriculture Booster (CSAb), that has the ambition to lead European Climate Smart Agriculture innovation platform, knowledge portal and marketplace, incubating scientifically-validated innovations, accelerating the adoption and the scaling of solutions, and facilitating transition to a climate-sustainable agriculture sector across Europe (and beyond). Examples on climate applications were provided, either at tactical (short-term) and strategic l(long term) levels. Between the toils, DSS for sustainable irrigation, starting from water balance calculation up to farmers advices were described. The use of water as a strategy to protect crops against extreme events (hot waves, spring and winter frosts) was exploited, as the possibilities to manage land use in accordance to the specific crop needs and the sorting out of more performant cvs to reduce pest management. Particular attention has been dedicated to mitigation practices able to reduce GHG releases and improve carbon stocks.

VIERI TARCHIANI

CNR – IBIMET, Lecturer

	<p>BIOSKETCH Full time researcher at IBIMET-CNR, experience in technical cooperation and research projects in developing countries in Agrometeorology, Disaster Risk Reduction and Adaptation to Climate Change, Natural Resources Management, Rural Development, Food Security Early Warning and Monitoring.</p>
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Abstract

Overview of CNR and of the Department of Biology, Agriculture and Food Sciences.

General introduction to the course

The lecture aimed introducing the course to Diplomazia students. An overview on CNR and the Department of Biology, Agriculture and Food Sciences was provided, highlighting the fundamental role of agriculture in the Mediterranean basin. Indeed, Mediterranean agriculture provides 95% of the world production of olive oil, 60% of wine production, 45% of the production of grapes, 25% of almonds, 20% of citrus and 12% of cereal production. Mediterranean agriculture is still largely climate dependent and smallholder farmers operating in rainfed systems are the most vulnerable. Relating to climate change and variability, a strong unplanned reduction of production in the Mediterranean for the above mentioned products could have an immediate impact on market prices worldwide. The impacts of climate and other global changes on Mediterranean agriculture make evident the limits in adaptation capacity of the various production systems. In this framework, the experience of IBIMET-CNR was described in relation with the course Programme and the specific lectures.

PIERO TOSCANO

CNR – IBIMET, Lecturer



BIOSKETCH

My primary research goals are directed toward promoting an integrative use of ground network monitoring and Earth Observation to foster Earth Observation Regional Networks by an integrative, iterative and multidisciplinary approach. My specialization is based on my skills and knowledge in developing new algorithms, working in GIS environments, analysing multisource satellite remotely sensed imagery and data, weather and climate scenario models in understanding spatiotemporal variation in ecosystem/urban structure and function and providing near real-time and long-term forecast to inform public and private sectors. In my spare time I enjoy a good happy hour with my friends and relatives, the sounds of a great music playlist, cooking lovely chinese meals with my wife and seeking adventure in the outdoors.

Abstract

Modelling and predicting durum wheat yield in Mediterranean environments.

Within the last years there has been a marked increase in the number of extreme weather events (mainly droughts, heat waves and late cold spell) affecting large regions and thus severely reducing crop production at a regional level. In the first section we have discussed about significant climate anomalies and events that during the last years affected both developing and developed countries, analyzing the different effects and highlighting the situation where the impact of weather can have dramatic conditions and threaten the food security of millions of people. Considering the current call for climate service to facilitate climate risk assessment and management, we have focused attention on what kind of information is used and needed by various actors and for what purpose it is to be used to facilitate demand-driven climate services. Whereas specific risks exist for each crop and region, an overview of the methods currently used to predict and assess the impact of weather conditions on durum wheat yield are given in the following sections. They included mainly crop-weather modeling combined with different source of information such as remote sensing and time series analysis of agricultural statistics. The following three examples have been discussed in detail by highlighting pros and cons especially when models are implemented as services in operation mode:

- 1) a model dedicated to the Italian durum wheat area, based on weather stations network and scenario analysis for forecasting yield, quality and diseases;
- 2) a model dedicated to the whole Mediterranean area, based on weather data and Earth Observation for forecasting yield and detecting surface area in production;
- 3) a model dedicated to the northern plains (US-Canada), based on weather data and Earth Observation for forecasting yield and detecting surface area in production.

FABRIZIO UNGARO

CNR – IBIMET, Lecturer



BIOSKETCH

Fabrizio Ungaro, born in Rome Nov. 15th 1965, graduated in Tropical and Subtropical Agriculture in 1991 at the University of Florence and got his PhD in Soil Science and Climatology in 1994. After a post doctoral fellowship at UC Davis in 1995-96, in 1997 he started his work as researcher at CNR, being responsible for soil surveys and teaching activities in Italy and developing countries (Kenya, Ethiopia, Niger). He has been contract professor of Pedology at the Natural Sciences Faculty of the University of Florence in 2007-2008, and from 2012 to 2014 he worked as post doctoral researcher at the Leibniz-Zentrum für Agrarlandschaftsforschung (ZALF), Müncheberg, Germany. His main field of research are pedometrics, environmental geostatistics, applied soil hydrology and soil based ecosystem services. He is a certified Kundalini Yoga teacher and loves dogs, gardening and vegetarian cooking.

Abstract

Soil ecosystem services at different scales: methodological approach at multiple governance levels-

The lecture presented to the Diplomazia2 fellows addressed the topic “*Soil Ecosystem Services at different scales: methodological approach at multiple governance level*”. The long use of soils by human populations over thousands of years is well documented, nevertheless explicit recognition by scientists and policy makers that soils fulfill many needs of human societies is surprisingly recent. In this lecture starting from an historical perspective on soil use, the different conceptualizations of the relationships between soils and human societies were examined, from the early categorizations in term of soil properties and functions to the more recent approaches framing soil within the larger ecosystem services framework. Despite of a certain delay compared to other environmental compartments, soils are nowadays put at the base of ecosystem services supply, and there is growing concern to explicitly include soils into the assessment of natural capital stocks. Examining the links between

soil properties, soil functions and soil services (Fig. 4.17) it was showed how to assess and map the potential and actual supply of soil based ecosystem services at different scales, from regional to municipal. It was further examined how land planning policies can affect the multifunctionality of soils in providing such services with a specific focus on land take due to artificial sealing of soil surface following urban expansion. Examples at different scales were provided to highlight the effects of soil consumption on securing food production and mitigating the effects of climate changes such as risk of flooding and climate regulation for a case study area in northern Italy (Fig. 4.18).

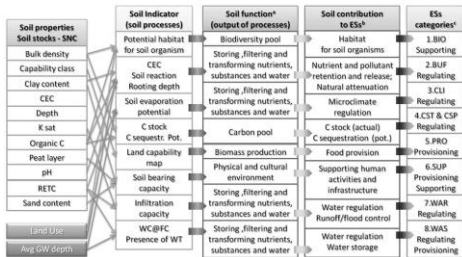


Figure: 4.17

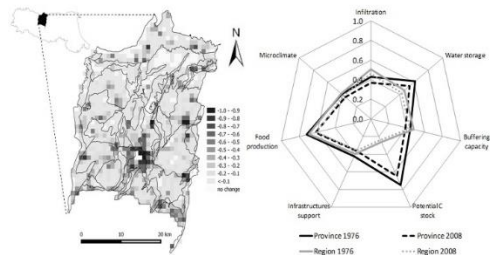


Figure: 4.18

FRANCESCO PRIMO VACCARI

CNR – IBIMET, Lecturer



BIOSKETCH

Research Scientist at IBIMET CNR (2002- present)
 Education: Agricultural Science Degree, University of Florence (1994); PhD in Ecology and Environmental Systems, University of Udine (2010).
 Research focuses: Plant Ecology; Climate Change Impact & Mitigation; Effects of high CO₂ on crops and natural ecosystems; Biosphere atmosphere interactions; Precision agriculture; Biochar.
 Publication record (updated June 2017): 61 ISI papers; H-index: 21 (Web of Science). Web pages
<http://www.fi.ibimet.cnr.it/staff-1/vaccari-francesco>
<http://www.researcherid.com/rid/C-2123-2009>
<https://scholar.google.it/citations?user=cCjrSaMAAAAJ&hl=it>


Abstract

Biochar as soil amendment for Mediterranean agriculture

In the Mediterranean area water scarcity is a major limiting factor for agriculture that currently accounts for the consumption of roughly 65% of available freshwater . The vulnerability of Mediterranean systems to water scarcity is predicted to increase in the near future as a consequence of larger inter-annual rainfall variability and higher frequency and intensity of extreme events such as droughts and heat waves. In this context, the identification and implementation of adaptation measures aimed at enhancing the resilience of the agroecosystems to water scarcity is a key priority to maintain both the quality and quantity of crop productions and protect water resources. Biochar is a coproduct of a thermochemical conversion of biomass that is recognized to be a beneficial soil amendment, which when incorporated into the soil increases soil water retention.

ROBERTO VALLORANI

CNR – IBIMET, Lecturer

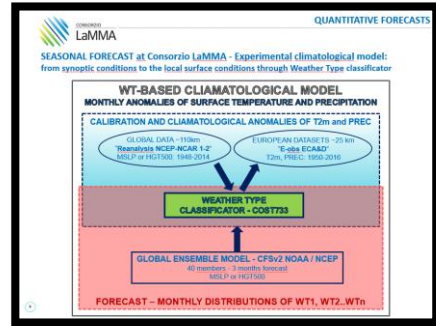
	<p>BIOSKETCH</p> <p>My main research topics at IBIMET-CNR (Institute of Biometeorology - National Research Council) are dynamic and synoptic climatology, applied climatology and meteorology. I work also as weather forecaster for LaMMA Consortium (Laboratory of Monitoring and Environmental Modelling for sustainable development), the Tuscany Region Weather Service supporting Civil Protection. My job is first of all my passion and the main goal of my working team is to develop a reliable seasonal forecasting system for Italy with an exportable operative chain for other Mediterranean countries. I'm also fond of mountain and I practice ski, tennis and beach tennis. My favorite hobby is hiking with my girlfriend Sara and my two heary dogs Wall-e and Maya, two beautiful Griffon vandeem.</p>
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Abstract

Seasonal Forecast

The lecture was focused on seasonal forecasting and the experimental numeric ensemble model for seasonal forecasting developed by LaMMA Consortium and IBIMET-CNR. The model version 2.0, still experimental, runs every day for the next 3 months on a monthly basis and produce several maps on European domain concerning 2 meters temperature (mean, maximum and minimum) and precipitation

(rainfall amount and rain days) with a resolution of 25 kilometers. The main output variables are the ensemble mean anomaly, the probability of exceeding climatological median and the probability of exceeding the upper and the lower climatological tercile. The surface climatological dataset is the regular grid E-obs gridded dataset. The model is driven by 500 hPa geopotential height (500HGT) and mean sea level pressure (MSLP) from the NOAA/NCEP CFSv2 global model that is a physical consistent coupled ocean-atmospheric ensemble model with 40 members. Each member of 500HGT and MSLP are the input variable of our model respectively for surface temperature and precipitation. The main core of the model is a circulation type classifier based on the COST Action 733 software package that has been optimized for Italy thanks to a specific work we carried out in order to find the most appropriated circulation type classification for surface temperature and precipitation («Circulation Type Classifications for temperature and precipitation stratification in Italy», Int. J. of Climatol., 2017, in press). An overview of the model and the classification methods that the model is based on was firstly given during the lecture, then a case study was presented in order to show the potential capability on predicting monthly precipitation anomaly and finally the application of the model to heavy precipitation was illustrated.





BIOSKETCH

Researcher at Biometeorology Institute (IBIMET) of National Research Council with 25 years of experience in technical cooperation and research projects in developing countries (West Africa, Horn of Africa and Caribbean) in the field of food security, natural resources monitoring, assessment of climate risk on agro-pastoral systems. Deep understanding of semi-arid crop production systems and their adaptation dynamics in response to climate changes. Competences in agro-meteorology, crop modelling, geographic information systems and use of remote sensing data (low and average resolution) for environmental monitoring. Strong experience in training design and implementation of early warning systems for drought monitoring, natural resources management, climate risk mitigation and vulnerability assessment in East and West Africa. Since 1995, I'm senior consultant of the World Meteorological Organization of United Nations (WMO/UN).

Fishing is my favorite hobby. I often go to the movies and I also love to reading and listening to music, especially jazz.

Abstract

Open source geoprocessing tools and meteorological satellite data for crop risk zones monitoring in sub-Saharan Africa.

In many regions of our planet, agriculture is still heavily dependent on rainfall regime while vulnerability of cropping systems raises as a result of climate change impacts and increasing human pressure on natural resources. In such a context, agro-meteorological information can play a key role in food security, strengthening farmer's resilience and improving crop productivity. A case study has been presented starting from IBIMET's experience in developing an open source web based application for crop monitoring in a semi-arid environment (4Crop). The proposed approach is meant to encourage the integration and sharing of interoperable and open source solutions so to contribute to the setting up of distributed climate services. A critical analysis

of the whole process was carried out in order to highlight key elements to be taken into account in implementing similar applications. In this sense, the user consultation process is the first step in order to better meet the needs of final beneficiaries both in terms of content and timing of information products. Involvement of primary users (national Meteorological Services) in front-end interfaces development and crop model outputs design is indeed another essential element for improving application usability. Web approach, based on innovative spatial data infrastructure increases accessibility of accurate drought risk information for different categories of stakeholders, bridging the gap between available technology and local users' needs. Finally, open source solutions can better ensure a long-term sustainability of these operational tools and, especially in developing countries, they can also play an important contribution for capacity building in local Institutions which are the main actors in planning and implementing effective action for food crises prevention and management.

EMANUELE ZUCCHINI

CNR – IBIMET, Lecturer



BIOSKETCH

I graduated in International Relations at University of Milan. Soon after completing a Post-Graduate Diploma in development project management, I worked four years in Sub-Saharan Africa countries, first as Project Manager for Italian NGOs, and afterwards as Monitoring&Evaluation officer at UNDP. From 2013 to 2017, I worked at IBIMET-CNR as Research Fellow in a research project between Italy and Senegal. I am currently PhD candidate in development economics at University of Florence. I love to travel finding out new cultures and peoples. I like the sea because it gives a feeling of freedom.

Abstract

Analysis of technical efficiency in economics through the Data Envelopment Analysis (DEA).

Technical efficiency (TE) is used to assess farm productivity and it reflects the ability of farmer to maximize the agricultural output given a set of observed inputs, for instance land, labour, fertilizers, or to minimize inputs use given the same level of output. Since Farrell (1957), TE analysis entails estimation of the frontier production function from the most efficient production units which defines the current state of technology, then a production unit might place on

the frontier, if it is perfectly efficient, or beneath the frontier, if it is not fully efficient.

Overall, increasing TE helps farmer to raise agricultural output or to reduce input use, given the same level of input and output. This is especially important in developing countries where agriculture is notably affected by input constraints and low level of technological change. Therefore, identifying sources of efficiency is a fundamental analysis to improve the performance of the agricultural sector.

Following Farrell (1957), several models have been developed, mainly the parametric approach of Stochastic Frontier Analysis (SFA), proposed by Aigner et al. (1977), and the non-parametric approach of Data Envelopment Analysis (DEA), proposed by Charnes et al. (1987). SFA estimates the production frontier from a specific production functional form and it is distinguished between deterministic and stochastic frontier. The deterministic model assumes that any deviation from the frontier is due to technical inefficiency. Instead, the stochastic approach decomposes the error term in an inefficiency term and a white noise term, that captures the random effects outside the control of the production unit, i.e. measurement errors and other statistical noise typical of empirical relationships. DEA is based on a mathematical programming techniques which linearly identifies a deterministic production frontier by determining the efficiencies of individual decision-making unit (DMU) within a group, relative to the other DMUs in the group. The most efficient DMUs constitute the production frontier of the group, relative to which the efficiencies of the remaining DMUs are measured³. Moreover, DEA measures input- and output-oriented TE. The former determines minimum inputs for which the observed production of the i -th DMU is possible, while the latter determines the maximum output of the i -th DMU given the observed inputs.

Since Ray (1991), the standard approach to analyse how different factors affect TE is to use a two-stage DEA analysis. This entails first to measure TE using DEA technique then to regress DEA efficiency scores on other explanatory variables. A recent literature (Ramalho et al., 2010; Hoff, 2009; McDonald, 2009) has suggested the fractional regression model (FRM) originally proposed by Papke and Wooldridge (1996). Moreover, the question whether efficient DMUs at unity value should be treated differently of inefficient DMUs leads to two options (Ramalho et al., 2010). A single-equation model which analyses DEA score of all DMUs, including the efficient ones. On the contrary, a two-equation model which analyses separately, efficient and inefficient DMUs ($y = 1$ vs. $y < 1$) and, then, the sub-sample of inefficient DMUs.

³ For a thorough review of DEA see Ramanathan (2003) and Cook and Seiford (2009).

SERGIO MOLINARI

CNR – IPSP, Tutor and Lecturer



BIOSKETCH

Senior scientist at CNR and responsible of the Biochemistry Lab. of IPSP located in Bari. Main research topic: study of plant immune system mechanisms; in particular, genetic and induced resistance (SAR, ISR, MIR, TIR) by treatments of plants with hormones, or with symbiont mycorrhizal or antagonist fungi such as *Glomus* and *Trichoderma* spp. Models are Solanaceae plants infected by soil-borne nematodes and mining insects. 67 papers published on International Journals (about 1274 citations, H-index 16). Hobbies: history, classics, literature; passion: nature life

Abstract

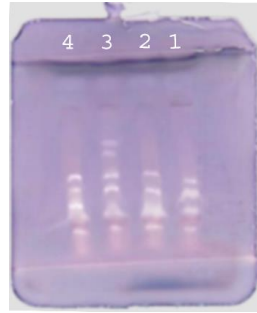
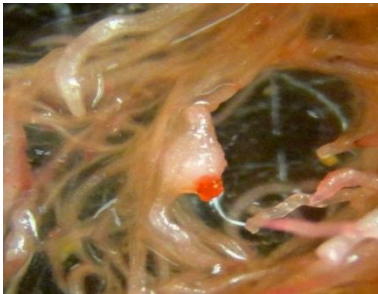
Lectures

- Important recent outbreaks of diseases caused by alien pests in Italy
- Plant parasitic nematodes (PPNs): biology, ecology, economic importance worldwide
- Effects of nematode infection on plants: symptoms
- Classification of PPNS according to their feeding behavior
- Ectoparasites: virus-vector nematodes; migratory and sedentary endoparasites
- Most important groups: Root Knot Nematodes (RKNs, *Meloidogyne* spp.), Cyst Nematodes (CNs, *Globodera* - *Heterodera* spp.)
- Possible effects of climatic global changes on the spread of nematode diseases
- Major strategies of nematode control adopted thus far
- Disadvantages of nematocide use
- Description of the Plant Immune System
- Phytobiome in soil and its relationships with roots
- Pathogens/Parasites different parasitism: Biotrophs, Necrotroph, Herbivores
- Immunity: Plant Defense Reaction to pests, Rapid Repression of Immunity in symbiont interactions
- Immunity: PAMP-triggered immunity (PTI), Effector-triggered immunity (ETI), hypersensitive Response (HR) - Effectors/Receptors interactions in plants

- Activation of Immunity in Nature: Systemic Acquired Resistance (SAR), Induced Systemic Resistance (ISR) - Resistance induced by Micorrhizal fungi (AMF) and antagonistic beneficial fungi such as *Trichoderma* spp. (MIR, TIR)
- Resistance Elicitors: phytohormones, functional homologs, fungicides, beneficial micororganisms
- PR-proteins: executioners of plant immunity

Main Lab Activities

- detecting parameters of RKN infection on plants: extraction and counting of eggs, egg masses, sedentary forms - detection of parameters of plant fitness - inoculation of plants: hatching of
- nvasive juveniles (J2) - biochemical assays: protein content, enzyme tests - miniature electrophoresis of cell extracts - staining for isoenzymes





BIOSKETCH

I am senior researcher in the Institute for Sustainable Plant Protection, CNR, in Bari. The bulk of my career is devoted to the study of viruses and virus-like diseases of the grapevine and other Mediterranean plants. During these studies I characterized new virus species and diseases, described their interactions with the plant and developed laboratory tools for virus diagnosis. The recent outbreak of *Xylella fastidiosa* on olive in my region allowed to expand my scientific interests to the genome analysis of this new bacterial isolate, to the olive response to the infection and to the development of containment strategies. These activities benefitted of high throughput techniques of sequencing that I have extensively applied in Plant Pathology. I participated to several national and international (H2020) research projects as responsible of work package or scientific coordinator. I was former member of the board of the Italian Society of Plant Pathology and currently member of the board of the International Council for the Study of Viruses and Virus-like disease of the grapevine. I authored more than 100 publications in refereed journals, abstracts to congresses and book chapters. I regularly do cycling, either mountain or road bike.

Abstract

A lecture entitled “Next generation sequencing (NGS) in Plant Pathology” was given to the Diplomazia 2 alumni. This subject is currently very debated, since it has gone beyond the research to move into an applied field of investigation. During the lecture an outline of the available techniques was given, highlighting their evolution throughout the time and their advantages/disadvantages. Particularly, the application of NGS in Plant Virology was in depth discussed providing a general overview of the diverse nucleic acids substrates, small RNA, double-stranded RNA and RNA, to sequence. Milestone manuscripts applying the technique in Plant Virology were presented with particular emphasis to the unbiased feature of the approach, which allows to study unknown diseases and to discover several new viruses in the absence of any preliminary molecular information. Examples of the discovery of new viruses in grapevine, citrus, fig, mulberry, persimmon and

quince, achieved in the laboratory to which I belong, were illustrated. The lecture continued with the application of NGS in the study of *Xylella fastidiosa* outbreak in Apulia illustrating the bacterial genome description and its molecular interactions with the infected olive plants.

Finally, an update of the impact of NGS in Plant Virology and its implication in production of plant propagation material, particularly for woody crops, was given. The subject was of interest in the frame of the program Diplomazia 2 since it refers to a new and powerful technique of sequencing that revolutionized the field of Plant Pathology and, generally, the study of pathogen/host interactions.

ANNALISA DE GIROLAMO

CNR – ISPA, Tutor and Lecturer



BIOSKETCH

Graduated with full marks in Biology at the University of Bari in 1997. Since 1998, she carries out research at the Institute of Sciences of Food Production of the National Research Council in Bari (ISPA-CNR) first as fellowship recipient and since 2001 as Confirmed Researcher. She has almost twenty years of experience in the field of mycotoxin analysis, mainly in: development and validation of chromatographic and rapid methods (mainly based on infrared spectroscopy) for mycotoxin determination in food products; organization of collaborative studies and proficiency tests for the analysis of mycotoxins in food. Involved in several national and EU-funded projects relevant to mycotoxins and scientific responsibility in several national/international projects of ISPA. She is co-author of 62 publications (39 of them on International peer reviewed journals).

Abstract

Within Diplomazia2 course, Dr. De Girolamo gave the following two lectures for a total of 6 hours. Below are reported titles and relevant main contents for each lecture:

- Performance characteristics and validation of analytical methods for mycotoxins (*June 8 2017*)
 - Definitions of performance criteria of analytical methods

- Criteria of analytical methods of mycotoxin established by CEN Report CR 13505/1999
- Methods of analysis for the official control of the levels of mycotoxins according to EU Regulation
- Interlaboratory and single-laboratory validation
- Example of development and validation of two Official/Standard Methods for fumonisins determination in cereals.
- (Certified) Reference Materials and Proficiency Testing (*June 12 2017*)
 - Definition of Quality Assurance (QA) program and Proficiency Testing
 - Preparation of (Certified) Reference Materials -(C)RM according to ISO Guides 30-35
 - Design of a certification project
 - Example of organization of a Proficiency Testing and evaluation of results

Mycotoxins contamination of agricultural food commodities and beverages poses a continuous risk to human and animal health due to their toxic effects. In order to protect consumers from exposure to mycotoxins through the consumption of cereal-based food products, the European Commission (EC) has set maximum permitted levels for several mycotoxins. The reliability of analytical results is essential when data are used in food surveillance studies to assess mycotoxin intake, for food control or for monitoring standards for trading purposes. In this framework, the aim of the two lectures was to give an overview of criteria and key elements for the validation process of conventional methods for mycotoxin determination in food.

MIRIAM HAIDUKOWSKI

CNR – ISPA, Tutor



BIOSKETCH

Chemist. Researcher at Institute of Sciences of Food Production, National Research Council of Italy (ISPA-CNR). Major areas of research activities: monitoring and risk assessment of mycotoxins in food and feed, mycotoxicology, mycotoxins and toxigenic fungi, development and validation of analytical methods for mycotoxins, fate of mycotoxins during food processing and biogas production, bio-detoxification and bio-binding of mycotoxins by microorganisms and enzymes. She published over 60 papers in several scientific

	journals relevant to the above topics, and is co-author of 1 patent.
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Abstract

Sanitary factors of mycotoxins:

Mycotoxins are secondary fungal metabolites, natural contaminants, that can contaminate cereals crops and stored food or feed. Mycotoxins, when present in sufficient levels, can cause adverse effects on humans, animals.

Clinical manifestation resulting from exposure to mycotoxins are known as mycotoxicoses. Mycotoxicoses can be differentiated as acute or chronic toxicity, or both, depending on the kind of toxin and the dose. The International Agency for Research on Cancer evaluated and classified the carcinogenicity of mycotoxins.

Mycotoxins have been ranked as the most important chronic dietary risk factor, higher than synthetic contaminants, plant toxins, food additives or pesticide residues.

Methodology for mycotoxin detection:

Mycotoxins are regulated since their presence in food and feed has a negative impact on national and international trade, resulting in significant economic losses.

Analytical methods allow the determination of mycotoxins in different samples at levels below the limits of the legislation. They can adapt to monitoring projects to obtain information on human and animal exposure to mycotoxins (risk assessment) and resolve any legal disputes between the parties.

During the lessons have been discuss different analytical methods as chromatographic (routine methods) based on sample pre-treatment, cleanup and detection techniques and immunochemical techniques.

VERONICA M.T. LATTANZIO

CNR – ISPA, Tutor and Lecturer



BIOSKETCH

Veronica M.T. Lattanzio graduated in Chemistry at the Chemistry Department, University of Bari, Italy, in 1999. She is actually researcher at the Institute of Sciences of Food Production (ISPA) of the National Research Council of Italy (CNR). Her main research topic is the development and validation of analytical methods for the detection of mycotoxin and other food contaminants either based on mass spectrometry techniques and immunoassays, including organization of collaborative trials and preparation of reference materials. She is Member of the Working Group “Biotoxins” (CEN/TC 275 WG5 “Food Analysis – Horizontal Methods – Biotoxins”), of the European Committee for Standardization, and she actually involved in the standardization of LC-MS multi-mycotoxin methods under the current standardization mandate. Since 2008 she is also deeply involved in validation of rapid methods for mycotoxin detection, in the framework of National and EU funded projects (CONFIDENCE FP7, MycoKey Horizon 2020). She also has specific expertise in identification, structural characterization and determination of mycotoxin metabolites and modified mycotoxins, study of fate of mycotoxins during food processing, identification and characterization of biomarkers for the evaluation of animal and human exposure to mycotoxins.

Abstract

Within Diplomazia2 course, Dr. Veronica M.T. Lattanzio gave a lecture for a total of 4 hours. Below is reported title and relevant main contents of the lecture:

- Liquid Chromatography – Mass Spectrometry for Multi-mycotoxin analysis in food (*May 19, 2017*)
 - Introduction to LC-MS analysis of mycotoxins
 - Target multi-mycotoxin quantitative analysis
 - Validation of LC-MS multi-mycotoxin methods
 - Target multi-mycotoxin screening and retrospective analysis
 - High resolution mass spectrometry for metabolite discovery

The lecture overviewed the latest advances in mycotoxin analysis in food by liquid chromatography-mass spectrometry (LC/MS). Despite the variety of

advanced instrumental approaches for improving mycotoxin detection, problems dealing with sample preparation and the choice of proper calibration for accurate quantitative analysis still remain to be solved. While the potential of tandem mass spectrometry for multi-mycotoxin quantitative determinations has been largely documented, actually there is an increasing interest in evaluating new MS detection approaches, mainly based on high resolution mass spectrometry (HRMS) to achieve quantitative screening of target mycotoxins, and retrospective analysis for the identification and characterization of unknown metabolites. A rapid increase of the number of methods for screening a large number (hundreds) of mycotoxins and related plant or fungal metabolites, including the so-called “masked forms”, is ongoing due to the increasing availability of new generation LC-MS(/MS). Finally, it is worth mentioning the strong trend towards the use of LC-MS(/MS) for the analysis of mycotoxins in multi-class methods, i.e. together with other residues or contaminants such as pesticides, plant alkaloids and veterinary drugs.

VINCENZO LIPPOLIS

CNR – ISPA, Lecturer



BIOSKETCH

Graduated with full marks in Chemistry at the University of Bari in 2000. Ph.D. in Microbiology, Safety and Chemistry of Food at Department of Plant Protection and Applied Microbiology, University of Bari in 2007. Since 2003 he carries out research at the Institute of Sciences of Food Production of the National Research Council of Italy (ISPA-CNR) in Bari. Involved in several national and EU-funded projects relevant to mycotoxins and scientific responsibility of the Regional project “Biodiversità per la valorizzazione e sicurezza delle produzioni alimentari tipiche pugliesi”. Fifteen-years of experience in analytical methods for mycotoxin detection. Has developed and validated several analytical methods based on conventional and rapid/innovative techniques for determining mycotoxins in food and beverages. He is co-author of 38 publications (22 of them on International peer reviewed journals).

Abstract

Within Diplomazia2 course, Dr. Lippolis gave one lecture for a total of 3 hours. Below is reported title and relevant main contents of the lecture:

- *Rapid methods for mycotoxin detection*

- Rapid methods: definitions and aims
- Introduction to Immunoassays
- Immunoassays/Immunosensors
- Indirect screening methods
- The use of alternative receptors
- Commercial rapid test kits
- Validation of rapid methods
- Examples of the validation for screening methods according to the Commission Regulation (EU) 519/2014

Mycotoxins are toxic secondary metabolites produced by filamentous fungi under a wide range of climatic conditions on agricultural commodities in the field and also during storage. The contamination of mycotoxins in food and feed products has been recognized to be an important safety issue for human and animal health. In order to protect consumer health to mycotoxin contamination, innovative strategies to improve monitoring programs are in high demand.

Because of the need for rapid and high-throughput screening, methods which allow testing of agricultural commodities with results within 20 min are gaining acceptance and are being integrated into routine monitoring procedures. In this framework, the aim of lectures was to give an overview on rapid methods for mycotoxins in food and feed and the importance of proper validation processes. In this regard, examples of the validation for screening methods according to the Commission Regulation (EU) 519/2014 have been shown.

MICHELANGELO PASCALE

CNR – ISPA, Lecturer



BIOSKETCH

Graduated in Chemistry at the University of Bari, Italy. Director of Research at the Institute of Sciences of Food Production (ISPA), National Research Council of Italy (CNR) in Bari. Involved in several national and EU-funded projects relevant to mycotoxins, has/had scientific responsibility in several national/international projects of ISPA. Has over 20-years of experience in development and validation of analytical methods for mycotoxin detection. From 2006 to 2015 has been responsible of the CNR project “Innovative methods for food characterization and control of mycotoxins, toxigenic fungi and allergens” of the CNR Department of Biology, Agriculture and Food Sciences (DiSBA). Speaker at several national and international Conferences/Symposiums. Author of 21 book chapters,

115 papers in peer reviewed journals and many contributions to national and international Conferences/Symposiums.

Abstract

Within the DIPLOMA² course, Dr. Pascale had two lectures for a total of 2 hours. Below are reported titles and main contents for each lecture:

- *Worldwide mycotoxin legislation, with a focus on Europe*
 - Factors influencing mycotoxin regulations
 - Worldwide mycotoxin regulating Countries
 - Limits for aflatoxins in food and feed
 - Limits for other mycotoxins in food
 - European Union mycotoxin regulations
- *Sampling and sample preparation methods for mycotoxin analysis*
 - Type of sampling procedures
 - Guidelines and EU Regulation for sampling (food and feed)
 - Treatment of the sample as received in the laboratory
 - Type of sample preparation (dry milling, slurry mixing)

Mycotoxins are toxic secondary metabolites produced by moulds, mainly *Aspergillus*, *Penicillium* and *Fusarium* spp. Cereals and cereal products, nuts, peanuts, almonds, pistachios, apricot kernels, dried fruit, spices, wine, beer, coffee and animal derived products (i.e. milk, eggs, meat, dry cured meat) may be contaminated by mycotoxins. It has been shown that mycotoxins cause adverse effects on human and animal health and serious economic impact worldwide. In order to protect consumers from exposure to these natural contaminants, legal limits for several mycotoxins have been established. Harmonized limits have been fixed in the EU.

Most mycotoxins, including aflatoxins, fumonisins and ochratoxin A, are unevenly distributed in grain, so that high concentrations of toxins could be found in “hot spots” or “pockets” in bulk storage of commodities. If the mycotoxin concentration in the test portion does not accurately reflect the concentration in the entire lot, then that lot maybe misclassified. Consequently, the collection of truly representative samples requires carefully designed sampling protocols.

In this framework, the aim of the two lectures was to give an overview on worldwide regulations for mycotoxins in food and feed and the importance of proper sampling for mycotoxin analysis. In this regard, a training video on sampling for the official control of levels of mycotoxins in foodstuffs has been shown.

CARLA BENELLI

CNR – IVALSA, Tutor and Lecturer



BIOSKETCH

Carla Benelli - Researcher at Institute of Tree and Timber, IVALSA, National Research Council, in Sesto Fiorentino (Florence)- benelli@ivalsa.cnr.it

Main research fields: Plant biotechnology, conservation of plant biodiversity

Current interests: tissue culture (micropropagation, synthetic seed technology), in vitro conservation and cryopreservation.

I like jogging and I love the sea in all seasons.

Abstract

The lesson took place on 12 May 2017 and it concerned issues related to the “In vitro propagation”. The topics dealt with during the lesson and the tutorial material provided have allowed the students to acquire extensive knowledge on techniques, methods and strategies of in vitro culture; moreover, traditional and innovative micropropagation techniques of herbaceous, fruit and woody species have been discussed. These topics agree with the purpose of scientific fields of Diplomazia2.

In order to bring about sustainable resource conservation and management, in fact it is essential to adopt several different approaches for managing biodiversity. Plant tissue culture forms an integral part of any plant biotechnology activity and biodiversity is in part a function of climate.

In vitro propagation technique is an alternative way to propagate and conserve a large number of plant species with poor and uncertain responses to conventional methods of propagation. In vitro plants can be used as a donor for plant production in order to conserve and reintroduce the acclimatized plants in their natural endangered habitats and for physiological studies of drought tolerance.

Plant tissue culture consists of a set of in vitro techniques, methods and strategies that are part of plant biotechnology and it exploited to create genetic variability, to improve the plant health and to increase the number of desirable genotypes available to the plant breeders.

Tissue-culture protocols are available for most crop species, although continued optimization is still required for many crops, especially cereals and woody plants. Tissue culture techniques, in combination with molecular techniques, have been successfully used to incorporate specific traits through

gene transfer. In vitro culture of protoplasts, anthers, microspores, ovules and embryos have been used to create new genetic variation in the breeding lines, often via haploid production.

Large-scale micropropagation laboratories are providing millions of plants for the commercial ornamental market and the agricultural clonally-propagated crop market. Tissue culture has opened new frontier in the field of agriculture offering opportunities for the increase in productivity, profitability, stability and sustainability.

The topics involved in the lesson are: theoretical and practical aspects of in vitro culture; callus, embryo, seed and suspension culture; somatic embryogenesis; phases of micropropagation (donor plant selection, establishment of axenic culture, shoot elongation and rooting, acclimatization); medium composition and plant growth regulators; growth conditions; critical issue (contaminations, somaclonal variation, browning and hyperhidricity).

Moreover, innovative micropropagation techniques, such as liquid culture in bioreactor and “temporary immersion system” (TIS) culture have been discussed. TIS is periodic semi-automated or fully automated cultivation systems, based on alternating cycles of temporary immersion of the cultured plant tissue into the liquid medium followed by dry period. Several semiautomatic systems using the temporary immersion principle have been described, all these systems allow to: a) avoidance of continuous immersion, b) provide of adequate oxygen transfer, c) provide of sufficient mixing, d) enable sequential medium changes and automation. TIS system can bring many advantages in micropropagation for automation and simplifying procedures and its application in different researches showed a general reduction of costs for plants production.

ANNA DE CARLO

CNR – IVALSA, Tutor and Lecturer



BIOSKETCH

Since 2010 I'm working as researcher in the *Institute of Tree and Timber, IVALSA*. I have got a Ph.D. in Plant Biotechnology for Tropical Productions, a Specialization Degree in Plant Biotechnology and a Degree in Biology.

My topics are: Plant biotechnology, tissue culture, *in vitro* conservation, stress plant physiology.

Abstract

The lesson took place in the afternoon of 12 May 2017. It covered issues related to the “In vitro conservation of plant germplasm” and is related to topics already well-approached by the teachers Dr.ssa Benelli and Dr. Lambardi, concerning in vitro micropropagation and cryopreservation of plant material.

Climate change, drought, deforestation lead to soil erosion, desertification and loss of biological diversity. To reverse the current trends of forest depletion, degradation of agroecosystem and loss of genetic resource an integrated strategy for resource management and maintenance of biological diversity is essential and urgent. Collaboration across discipline is necessary to plant conservation responses to climate change adequately.

The relevance of biotechnology to the conservation of plant genetic resource has to be considered in terms of conservation strategies. *In vitro* conservation is an attractive method that can support traditional approaches such as *in situ* conservation, seed banks, arboretum, botanic garden and gene-field banks.

After an excursus on different *in situ* and *ex situ* conservation methods, the lesson explored the *in vitro* conservation methods and, in particular, the “Slow growth storage”.

Slow growth storage is a medium term method using *in vitro* culture with the aim to increase the interval between subcultures by reducing growth. This is achieved by modifying the environmental conditions and/or the culture medium. At the end of a storage period, cultures are transferred onto fresh medium and usually placed for a short period in optimal conditions to stimulate regrowth, before the next storage cycle. Slow growth storage enables the maintenance *in vitro* of shoot cultures in aseptic conditions by reducing markedly the frequency of periodic subcultures (from few months to one year or more, depending on the species), without affecting the viability and regrowth potential of shoots. This technique can be used in commercial micropropagation laboratories to maintain stock cultures, it is a convenient option for medium-term conservation of shoot cultures in commercial laboratories which needs today to widen the offer of species and cultivars and achieve to a better organization of their productions. Indeed, the technique allows a significant extension of the interval between subcultures, thus reducing the costs of stock culture maintenance, as well as the risks of contamination during subculturing. The several factors that influence the potential of plant recovery after conservation have been widely discussed and numerous examples have been taken into account.

Another topic discussed during the lesson was: “synthetic seed technology” as one of the most important applications of plant tissue culture. It combines the advantages of clonal propagation with those of seed propagation (i.e., storability, easy handling and transport, use of sowing equipment, protection against diseases and pests). The encapsulation technology consists of the inclusion of some small plant portions in a nutritive and protective matrix. The

primary goal of artificial seeds was to recover whole plantlets from synthetic seed under *in vitro* or *ex vitro* conditions. This technology represents a further and promising tool for exchange of plant material between private and public plant tissue culture laboratories, for short- and medium-term storage of valuable plant material and for use of *in vitro*-derived or micropropagated propagules directly in farm or in nurseries.

The practical part of the lesson concerned the analysis and comment with the students of an article, related to the topics discussed.

CRISTIANA GIORDANO

CNR – IVALSA, Tutor



BIOSKETCH

Cristiana Giordano, graduate in Biological Sciences, PhD in Biosystematics and Plant Ecology at the University of Florence, is researcher at CNR (IVALSA Institute). She has worked on reproductive and plant systems biology. For 10 years she has been Director of CeME Centre of Electron Microscopy of CNR at the Research Area of CNR Sesto Fiorentino. Her research focuses on the study at cellular and ultrastructural levels of plant exposed to abiotic stresses (salt, drought-water, light-dark, UV radiation, heavy metals); on morpho-anatomical characteristics and adaptations to the environment of the Mediterranean flora; on plant systematic.

Abstract

Agro-biodiversity Phenotypic and Genotypic analysis (Cristiana Giordano, Raffaella Petruccelli)

Global climate change will affect the biodiversity as natural distribution and reproduction rates of species, ecosystem structures and functions, since the difficult for plant and animal species to adapt to the new conditions. Risks are numerous also for agriculture and agrobiodiversity. Nevertheless, agrobiodiversity may play a crucial role offering genetic resources in plant breeding and in the selection of cultivars for resistance to drought, heat and consequent diseases.

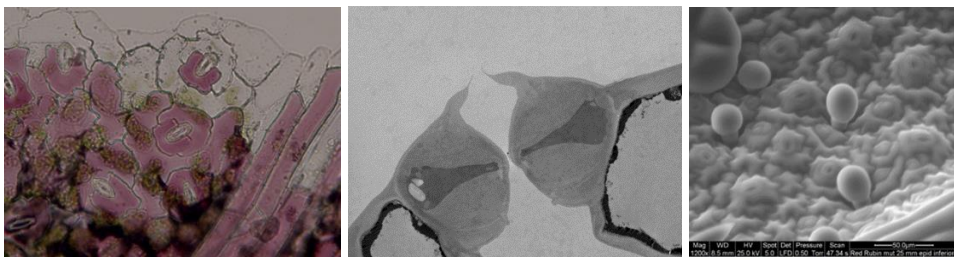
Our lesson focused on the characterization and valorization of agrobiodiversity.

In the characterization section we shown the micro and macro morphological methods to describe cultivars, moreover the genetic identification by molecular markers. For the valorization part, products of secondary metabolism (polyphenols, carotenoids) and susceptibility and tolerance to abiotic stress were treated.

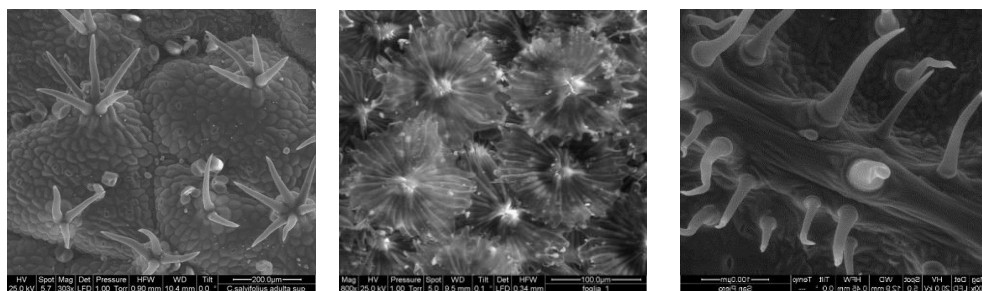
Macro-morphological characters were illustrated: what is a descriptor (botanical taxonomical descriptors, evaluation descriptors, morpho-agronomic descriptors), how to make a pomological card, how to compare different traits.

The use of microscope is necessary to evaluate micro-morphological characters. After analyzing the physical principles of microscope, different kind of instruments were described: light microscope (LM), transmission electron microscope (TEM) and scanning electron microscope (SEM) and environmental scanning electron microscope (ESEM). Additionally, it was highlighted the structure and function of different techniques, best practices, kind of sample, sample preparation and staining, image information mechanisms and kind of information from different microscope.

Anatomical and physiological modifications of plant under abiotic stress conditions were briefly illustrated: microscopic examinations of morphological, anatomical and ultrastructural responses and/or damage in leaf were shown, while for physiological modifications chlorophyll fluorescence measurement were described.



Stoma, guard cells image from Light Microscope (left), Transmission Electron Microscope (central), Environmental Scanning Electron Microscope (right)



Different kind of leaf trichomes: *Cistus salvifolius* (left), *Olea europaea* (central), *Ficus carica* (right)

ALESSIO GIOVANNELLI

CNR – IVALSA, Lecturer



BIOSKETCH

Alessio giovannelli is researcher at the Tree and Timber Institute-CNR, Florence and he is in charge at the Laboratory of Xylogenesis. He achieved a degree in Forest Sciences, Faculty of Agriculture of Florence, (1993) and a Postgraduate Diploma in Plant Biotechnology at the University of Pisa (1996). He was appointed as italian delegate for the WG 1 "Wood formation" - COST Action E 28 "Genosilva" (2004-2007) and he has served in the Scientific Committee for forest species – ARSIA Tuscany (2007-2010). He has been the scientific coordinator of the projects: "Global change, water resources and wood quality: new strategies for poplar" (2007-2009) and "System biology of the plant response mechanisms to climate change: models for the development of biotechnology and agro-forestry applications for biomass production (Sysbiofor) (POR CRO ESF 2012-2014). He was Associate Professor at Dep des Sciences fondamentales, Université du Quebec - Canada (15.12.2010-14.12.2013) and Affiliate Reseracher at the Scuola di Studi Superiori Sant'Anna di Pisa (2017-2020).

Main activities: study of wood formation in forest trees; setting models for the development of biotechnology and agro-forestry applications for biomass production; Study of the effect of environmental stress on the biomass production in short – medium term poplar plantations; biochemical characterization of cell wall

	<p>components of feedstocks used for biofuels production (<i>Arundo donax</i>, olive waste).</p> <p>He's author of 42 international publications on ISI journals in agro-forestry, bio-energy production and plant physiology.</p>
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Abstract

Traditional forest management is mainly based on the measure of stand specific wood volumes and on the prediction of biomass increment assessed through the construction of periodical inventories. Such approach, though providing useful tools to forest planning, does not contribute to the prediction of the technological properties of the timber. Furthermore, the new focus on sustainable forestry requires considering ecological and socio-economic aspects, especially in the attempt to anticipate future needs under global climate changes. The prediction of the biomass increment and of the quality of resulting wood, needs the identification of clear correlations between the variation of ecological parameters, the biological process of wood formation and the resulting timber quantitative and qualitative production. Trees respond sensitively to changing environmental conditions and observable effects of climatic variations include, for example, short and long term variations of stem radial growth and inter-annual discrepancies in the timing of wood formation phenophases. Wood quality depends on the physical and chemical features of the woody rings which in turn depend on the rate of cambial cell division (number of xylem cells produced) and the duration of the main phases of xylogenesis (cell expansion, cell death, lignification). It remains unclear how specific environmental factors influence cambium cell division, cell differentiation and xylem maturation that collectively define ring features.

In this frame the lesson “Wood formation in a changing environment” was ideally shared in four parts: a) general overview on the wood supply chain; b) concept and basis of wood quality; c) biology of wood formation; d) tools and devices to study wood formation.

Each side addressed themes focusing on specific topics with a bottom-up approach starting from the general aspects of forestry production, the role of forest in the mitigation of climate change effects, the wood quality, the wood formation and the involvement of biotechnologies to improve specific woody traits. The study of wood formation represents a key step to understand how CO₂ is long-term fixed in woody structures and consequently to highlight the carbon sink behaviour of mature forest or plantations. Moreover, these studies

are of utmost importance as they provide the biological scientific basis for better understanding the role of forests and plantations in the mitigation of climate change effects.

MAURIZIO LAMBARDI

CNR – IVALSA, Lecturer



BIOSKETCH

Maurizio Lambardi is Senior Researcher of the National Research Council (CNR) of Italy at the IVALSA Institute, and appointed Full-Professor in arboriculture and forests. He is also **Member of the Board** for Italy of the ISHS (International Society of Horticultural Science) and **Chairperson** of the Commission Molecular Biology and In Vitro Culture, **General Secretary** of the Italian Society of Horticulture, **Coordinator** of the Italian Working Group 'Micropropagation and in vitro technologies', **Corresponding Academic** of the "Accademia dei Georgofili", and **Member of the Editorial Board** of several ISI International Journals dealing with plant tissue culture and cryopreservation. He is author or co-author of over **170 full-length papers** and **Editors** of international books on micropropagation and tissue culture. He played for many years soccer and tennis, today he likes to make long walks in the mountain and in the forestry.

Abstract

The preservation of plant biodiversity is nowadays a priority, and involves action to halt or greatly reduce the loss of genetic resources due to natural factors (desertification and climate change), or induced by human action (such as deforestation, crop specialization, urbanization). It is estimated that there are around 400.000 plant species in the world (representing more than 1/3 of all the plant species of the globe), and at least 25% are threatened with extinction (in: www.bgci.org/plant-conservation/threats/). Consequences are dramatic in terms of genetic improvement for the loss of important traits of which these species are repository, as well as of natural products useful for health or nutrition. To block this "bleeding" of genetic resources, since the 70's it was initiated, at world level, an important work of collection, characterization and ex-situ storage of plant biodiversity in seed banks and in field clonal collections, thanks to which are estimated at almost 7.5 million the

accessions today preserved in collections managed by international organizations, national and regional authorities, and private companies (FAO, 2010), 90% of which are held in seed banks.

With regard to tree species, the preservation of genetic resources is traditionally implemented in seed banks (for species mainly reproduced by gamic propagation) or through the establishment and maintenance of clonal collections (for vegetatively-propagated species). However, biotechnology offers today important options for the collection, molecular characterization, disease indexing, pathogen elimination, propagation, documentation, preservation and exchanging of disease-free plant genetic resources. In this context, the application of the tissue culture technology to the preservation of plant genetic resources has greatly evolved in recent years, allowing the development of effective procedures of long-term maintenance of *in vitro* explants by cryopreservation.

Plant cryopreservation (i.e., the conservation of specimens in liquid nitrogen, at -196°C), since its development in the early 1960s, is considered an extraordinary method of safe long-term conservation of biological material, as it does not induce genetic alterations and preserves the regenerative potential of the stored material. The lessons presented at Diplomazia2 are an exhaustive overview of the the cryo-methods that are today available for the conservation of various woody species explants (Fig. 4.19) either from *in vitro* culture (shoot tips, embryogenic callus), or directly collected from trees in the field (seeds, pollen, dormant buds).

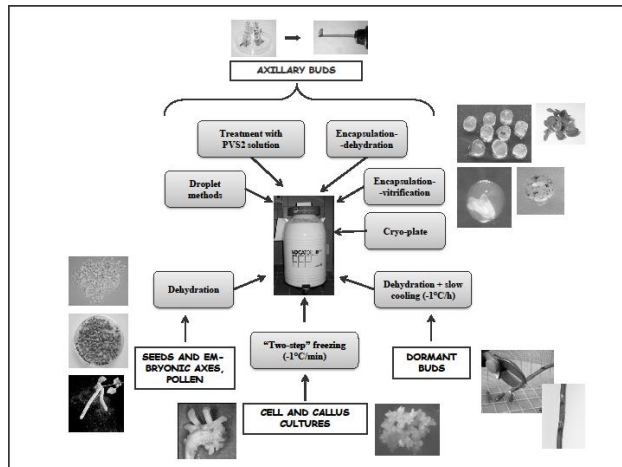
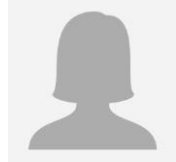


Figure 4.19: Methods for the cryopreservation of various tissue and organs from *in vitro* and in field-cultured woody species (from Lambardi and Shaarawi, 2017, in press).

RAFFAELLA PETRUCCELLI

CNR – IVALSA, Tutor



BIOSKETCH

Raffaella Petrucelli, graduate in Agriculture, University of Florence, PhD in Plant Biology Biosystematics and Plant Ecology at the University of Florence, is researcher at CNR (IVALSA Institute). CNR fellowship (3 years), research in vivo and in vitro propagation of olive plants. Her research interests is focused on the protection of biodiversity in fruit trees and wood species, the valorization of cultivars and varieties. Among his main expertise: a) the study morphological and genetic characterization, b) the varietal differentiation; c) evaluation of fruit quality and chemometric analysis.

Abstract

Agro-biodiversity Phenotypic and Genotypic analysis (Cristiana Giordano, Raffaella Petrucelli)

Global climate change will affect the biodiversity, as natural distribution and reproduction rates of species, ecosystem structures and functions since the difficult for plant and animal species to adapt to the new conditions. Risks are numerous also for agriculture and agrobiodiversity. Nevertheless, agrobiodiversity may play a crucial role offering genetic resources in plant breeding and in the selection of cultivars for resistance to drought, heat and consequent diseases.

Our lesson focused on the characterization and valorization of agrobiodiversity.

In the characterization section we shown the micro and macro morphological methods to describe cultivars, moreover the genetic identification by molecular markers. For the valorization part, products of secondary metabolism (polyphenols, carotenoids) and susceptibility and tolerance to abiotic stress were treated.

Genetic or DNA based marker techniques are routinely being used in ecological, evolutionary, taxonomical, genetic diversity of germplasm and genetic studies of plant sciences. In the lesson have been illustrated the different molecular marker methods as restriction fragment length polymorphism (RFLP), random amplified polymorphic DNA (RAPD), amplified fragment length polymorphism (AFLP), inter-simple sequence repeats (ISSRs), and microsatellite or simple sequence repeat SSR),

highlighting the principles of different markers, their advantages as well as limitations. Have been reported the applications of molecular markers (RAPD AND SSR) in DNA fingerprinting and genetic diversity studies in plant fruits (olive, fig, ecc.)

For the biodiversity valorization have been illustrated the extraction techniques and HPLC analysis of different polyphenol compounds and the antioxidants activity of the leaves and fruits of olive and fig.

Finally, it was exposed some statistical analysis methods (Principal Component Analysis) to elaborate data of the plants characterization.

PCA is a data compression method widely used to analyze data set containing many variables. It linearly combines the original variables, creating a new set of orthogonal variables called scores. The first component (PC₁) has the maximum possible variance among all linear combinations of the original variables. Each subsequent PC has maximum variance according to the constraint of orthogonality with all lower-order PCs. The contribution of each variable to a PC is expressed by a set of loadings (i.e. the coefficient of the linear combination). The study of loadings allows detection of the most important variables (i.e. with high variance) and the correlation among original variables. PCA is powerful tools which often permit a relatively simple representation of similarities between cultivars and accessions. Were described the principles of PCA and illustrated some case studies.

MARIA GALLITELLI

ALSIA Research Center in Metaponto (MT, Italy), Tutor



BIOSKETCH

Degree in Biological Sciences, Master in Molecular Biology and Project Management. Knowledge of molecular and genetic analysis (e.g. Linkage and QTL analysis); hands-on experience in working with plants and in processing and analyzing data.

Research experiences in a world class research centre with state of the art facilities and scientists from all over the world.

I am currently involved in a project that focusing the attention on the issues of bio-based economy and innovation as potential key factors for the economic development of the regions of Southern Italy, in the new European strategy for 2020, the new programs such as Horizon 2020 and the Regional Structural Funds.

	<p>The Research Center Metapontum Agrobios carries out activities to develop and transfer innovations of agriculture and agro-industrial system through agronomic and analytical research and services with its approaches of plant biotechnology, that's why we are one of the component of the Regional Cluster of BIOECONOMY.</p> <p>My passions are sorted out: traveling, cinema, books, walking, tennis table.</p> <p>I am also very much interested in politics as a significant component of the communities with responsibility for defining strategic development solutions of public interest.</p>
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Abstract

As a Scientific coordinator at ALSIA Research Center in Metaponto, I followed three students in a “practical way” and in defining a scientific program the best for their skills and better responding to the course aims. After a general presentation to all the Research Center staff, the students described their previous studies, their skills, and their expectations. In relation to their different background , we defined a scientific program for each one.

AISSA AROUS - Exploitation of High Throughput Phenotyping by Imaging (HTP) for the investigation of plant stress responses to abiotic stresses related to climatic changes in horticultural crops.

MARSELA LUARASI - Sustainable Use of Genetic Resources in Bio-economy Development

RASHA RAMADAN - Use of abiotic plant stress response genes via molecular breeding to improve tomato resilience to abiotic stresses related to climatic changes

As a tutor of MARSELA LUARASI I instructed her at the current research work, which is focused on Bio-economy intended as “territorial” regeneration, that can become a unique opportunity to reconnect the economy with society, overcoming the current rootless model based on expansion and undifferentiated quantity, in order to enhance the value of regional diversity and the quality and origin of products through a combination of tradition and innovation.

The bioeconomy as a competitive agricultural system, of fundamental importance, that produces raw materials in the form of biomass and by using Industrial technologies, is able to fully utilize the biomass to obtain different products that can be placed along the segments of the pyramid of the value, such as, from the top to the bottom, drugs, nutraceuticals, cosmetics, biopolymers, bioenergy.

RINA IANNACONE

ALSIA Research Center in Metaponto (MT, Italy), Tutor



BIOSKETCH

I am Molecular Biology and Biochemistry Group Leader for ALSIA – Research Center Metapontum Agrobios since 2003; my main interests are in unravelling the mechanisms that control plant genes under Abiotic Stresses and in Molecular Farming. I've been Component of the Management Committee of COST action FA605 (Signalling control of stress tolerance in plants) and FA0804 (Molecular Farming: Plants as a Production Platform for High Value Proteins"); Member of the External Advisory Board for the EU project 3to4 (Converting C3 to C4 photosynthesis for sustainable agriculture); Evaluator of several EU programs in FP7 and H2010. Evaluator of projects founded by FCT (Portugal). I like to travel, and to be in touch with different countries and cultures.

Abstract

I've trained the student Rasha Eid from Egypt.

Our program consisted in two main action (subproject 1: ADC and Subproject 2: HSF)

1. evaluation of tomato plants transformed with the ADC1 or ADC2 (Arginine Decarboxylase) gene in order to assess the presence and the expression of the transgene by using molecular biology methods and to evaluate the drought stress tolerance in transgenic plants using the High Throughput Imaging (LemnaTec Scanalyzer Platform).
2. Transformation of tomato cotyledons with constructs containing Heat Shock Factors genes under transcriptional control of pollen tissue-specific promoters.

Subproject 1: Rasha was in charge to sow T2 tomato transgenic seeds obtained few years ago in the frame of the EU project ROST run in collaboration with Prof Antonio Fernandez Tiburcio (University of Barcelona - Spain).

Polyamines represent a class of molecules that are involved in several physiologic events in plants such as embryogenesis, organogenesis, leaf senescence, fruit development and stress responses (Tiburcio et al 2014). In fact, the modification of polyamine biosynthesis obtained by overexpressing the gene Arginine decarboxylase 2 (ADC2) led to the generation of *Arabidopsis thaliana* plants that have shown phenotypic differences in comparison with wild type plants and were more tolerant to drought (Alcazar et al 2010). However, the assessment of plant phenotype during molecular breeding processes for abiotic stress tolerance is extremely important since the non-destructive analysis of the phenotype can greatly help in the selection of genotypes that better cope with the imposed stress. Consequently, the availability of HTP can speed-up the selection of stress tolerant plants.

During the stage in the frame of Diplomazia 2 Rasha started the experiments for the assessment of drought tolerance in tomato plants expressing the ADC1 or ADC2 gene. Namely, tomato seeds were sown in soil in small pots. At the stage of first leaves 100 mg of plant tissue was detached for DNA extraction. AS soon as the presence of the ADC1 or ADC2 were confirmed in the tomato progeny, plants were selected for gene expression analyses (real time PCR) and for drought tolerance via high throughput phenotyping. Experiments are still running

Subproject 2: Rasha was in charge to transform tomato cotyledons with Heat Shock Factors genes under control of pollen specific promoters. The aim of this work is to obtain pollen grains that are tolerant to high temperature. In this case the transformation experiment was started and some regenerated shoots were selected on antibiotic-containing media. At the moment, putative transgenic plants are rooting onto antibiotic-containing media.

The training experience was nice and beneficial. It goes beyond the scientific aspect and it was a very good opportunity to meet people with different background and culture.

ANGELO PETROZZA

ALSIA Research Center in Metaponto (MT, Italy), Tutor



BIOSKETCH

Dr. Angelo Petrozza, Agronomist, is a senior scientist responsible for the Agronomic Unit in ALSIA - Metapontum Agrobios Research Center with specific experience in plant phenoimaging, field trials and breeding. He has carried out research activities on several projects concerning nutrition and the defense of different crops. He has worked as the Director of Study to assess the effectiveness of new phytosanitary products for the Italian Ministry of Agriculture (Mi.P.A.F). He is responsible of the High Throughput Plant Phenotyping Platform (HTPP) in ALSIA. Currently he is involved with the high throughput analysis of plant phenotypes by image analysis. The platform allows the quantitative, non-destructive analysis of different crops or model plants under high-throughput conditions. Current work involves the evaluation of phenotypic responses of plants to abiotic stresses and new nutritional formulae.

Abstract

Student: AISSA AROUS

Title of trial: Exploitation of High Throughput Phenotyping by Imaging (HTP) for the investigation of plant stress responses to abiotic stresses related to climatic changes in horticultural crops.

In the spring of 2017, a trial was conducted to assess the effect of three varieties of greenhouse tomatoes (MoneyMaker, Ikram and Sitiens). Then, we analyzed two composite soil samples (sandy soil and clay soil) from the study site (Texture, Organic matter content and Electrical Conductivity) to determine and identify the water characteristics of these two soils.

The state of stress and phenotypic response of a plant was assessed by using an automated plant phenotyping platform equipped with image capture and processing technologies (Scanalyzer 3-D system; <http://www.lemnatec.de/>) which combines the ability to phenotypically analyse many plants with a high processivity and reproducibility. The system consists of three parts: a plant storage and conveyor unit, an imaging unit with three imaging chambers, RGB (visible), UV (ultra violet) and NIR (Near infrared) cameras and finally an informatic station to analyse the plant morphometric parameters. RGB

imaging was used to analyse tomato plants with respect to their dimensions (eg. height, mass/volume), and color composition. UV fluorescence images were used to evaluate photosynthetic efficiency of plants. NIR images were used to evaluate the water level of plants.

Chapter 5

Course 3

Governance of knowledge, management, preservation, enhancement and sustainable use of Cultural Heritage

Sergio Ribichini*, Lucia Alberti³, Giuseppe Cacciaguerra¹, Salvatore Piro⁴, Heleni Porfyriou², Khaled Dhifi, Mitrojorgji Joli, Aleksandra Lalatovic, Bozena Miljic, Mohamed Morsy, Mina Magdy, Inis Shkreli, Samuele Barone¹, Giacomo Biondi¹, Fabio Caruso¹, Antonio Cavallaro¹, Massimo Cultraro¹, Licia Cutroni¹, Giovanni Fragalà¹, Gaetana Marchesini¹, Lighea Pappalardo¹, Antonella Pautasso¹, Danilo Paolo Pavone¹, Paolo Romano¹, Salvatore Russo¹, Stefania Santangelo¹, Alessio Toscano Raffa¹, Susanna Bracci², Emma Cantisani², OANA Adriana Cuzman², Fabio Fratini², Laura Genovese², Loredana Luvidi², Donata Magrini², Fernanda Prestileo², Silvia Rescic², Barbara Sacchi², Barbara Salvatori², Antonio Santonetti², Eleonora Stella², Silvia Alaura³, Laura Ambrosini³, Diego Baldi³, Vincenzo Bellelli³, Enrico Benelli³, Marco Bonechi³, Massimo Botto³, Alessandra Caravale³, Maurizio Del Freo³, Antonio D'Eredità³, Silvana Di Paolo³, Andrea Di Renzoni³, Giuseppe Garbati³, Lorenza Ilia Manfredi³, Paola Moscati³, Ida Oggiano³, Tatiana Pedrazzi³, Alessandra Piergrossi³, Irene Rossi³, Carla Sfameni³, Candida Felli³, Andrea Angelini⁴, Cinzia Bacigalupo⁴, Emiliano Di Luzio⁴, Andrea Di Somma⁴, Andrea Ferdani⁴, Roberto Gabrielli⁴, Elena Gigliarelli⁴, Auguto Palombini⁴, Eva Pietroni⁴

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1. CNR – IBAM, <http://www.ibam.cnr.it>
2. CNR – ICVBC, <http://www.icvbc.cnr.it>
3. CNR – ISMA, <http://www.isma.cnr.it>
4. CNR – ITABC, <http://www.itabc.cnr.it>

Since the beginning of the course, the timetable introduced the fellows to an intense program of academic lectures accompanied by laboratory activities, field visits and painstaking fieldwork. The four Institutes involved (IBAM, ICVBC, ISMA, and ITABC) offered an overarching approach to cultural heritage knowledge, conservation and valorisation, utilizing both innovative methodological tools and an interdisciplinary method, thus challenging their disciplinary background. The course was organized in the following way:

1. three *Didactical Sections*,
2. three major *Operative Modules*,
3. a *General Flowchart*,
 - a) with four *Flow Levels*,
 - b) and twenty-six *Educational Panels*.









The three *Didactical Sections*, or Teaching Units are composed of: 1) **Theoretical Section**, that is 160 hours of lectures mainly concentrated in the first part of the course, in order to offer the basic knowledge and to support the development of the other two sections of 560 hours; 2) **Practical Activities**, that is laboratories, archaeological excavations and field work; 3) **Complementary Activities**, that is guided tours to museums, historic towns, monumental and archaeological sites, cultural institutions, and research work.

The *Major Modules* correspond to three thematic areas, that is: 1) **Territory**: Landscape, cultural contexts; 2) **City/Sites**: Archaeological sites, historic centres; 3) **Objects**: Stone materials, paintings, metals, buildings, etc.

The four *Flow Levels* that are part of the *Flowchart* show the various activity levels in which our approach to cultural heritage was performed: 1) **Knowledge**; 2) **Diagnostic & Monitoring**; 3) **Conservation & Restoration**; 4) **Valorisation & Fruition Systems**.

The *Panels* correspond to the participation of the CNR experts in the training program. All the didactic activities carried out are described in the relative report of the teachers of Course 3, organized according to the participation of the four different institutes (see 'Final Report, Teachers Course 3').

This is the general **Framework** of the course on Cultural Heritage.

	<div style="text-align: center;">  FLOW LEVELS  </div>			
MODULES ↓			PANELS ↓	
A. Territory <ul style="list-style-type: none"> • <i>Landscape</i> • <i>Cultural contexts</i> 	<ol style="list-style-type: none"> 1. Ancient Mediterranean history (ISMA) 2. Geophysical methods and techniques (ITABC) 3. Reality-based acquisition methods and techniques (ITABC) 4. Roman and Medieval Landscapes in the Mediterranean regions (IBAM) 			<ol style="list-style-type: none"> 5. Virtual Heritage, theory and practice (ITABC) 6. Remote Sensing Methodologies and technologies for enhancement and fruition of historical landscape (IBAM) 7. Integrated and sustainable valorisation (ICVBC)
B. City / Sites <ul style="list-style-type: none"> • <i>Archaeological Sites</i> • <i>Cultural Parks</i> • <i>Historical centres</i> 	<ol style="list-style-type: none"> 8. Archaeology and history in urban centres and archaeological sites (ISMA) 9. Urban planning and urban archaeology of Sicilian towns from Greek period to present (IBAM) 10. Archaeology and the city, theory and field work (ICVBC) 	<ol style="list-style-type: none"> 11. Archaeological and geophysical methods and techniques for diagnostic analysis of cultural heritage in urban contexts (IBAM) 	<ol style="list-style-type: none"> 12. Preventive and planned maintenance (ICVBC) 13. Sustainable conservation in historic buildings and city centres (ITABC) 	<ol style="list-style-type: none"> 14. Valorisation and fruition in historical centres and archaeological sites (ISMA) 15. Cultural tourism and management of historic centres (ICVBC) 16. GIS platforms and Web-GIS systems for fruition of urban cultural heritage (IBAM)

C. Objects <ul style="list-style-type: none"> • <i>Stone materials (natural/artificial)</i> • <i>Paintings</i> • <i>Mosaics</i> • <i>Metals</i> • <i>Monumental buildings</i> 	17. The archaeological object in context (ISMA) 18. Materials and decay phenomena (ICVBC) 19. Ceramics and material culture from Hellenistic to Medieval period (IBAM)	20. Non-invasive and portable devices (ICVBC) 21. Benchtop instruments for micro-destructive analysis (ICVBC) 22. Methods of archaeometric analysis for characterization of ceramics (IBAM)	23. Conserva-tion (ICVBC)	24. Collecting actions: from private collections to the Museum concept (ISMA) 25. Digital methods and techniques for fruition of librarian heritage (IBAM) 26. Platforms and immersive galleries for fruition of architectural and monumental heritage (IBAM)
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The three Teaching Units (Theoretical, Practical, and Complementary) developed the Modules for a total of more than 720 hours. The realization of the course was entrusted from time to time to one of the four institutes. Each institute worked in synergy with the others, applying the Flowchart and deepening the subject of the course according to the specific skills of its own researchers/teachers.

In order to reach the goals, it was necessary to create a well planned structure, with a Scientific Advisory Board and three Secretariats (didactic, administrative and technical). This structure helped the Coordinators' team and the General Scientific Coordinator carry out all envisaged activities, also in logistic terms and in small daily issues.

Some multimedia tools served to the purpose, facilitating the educational activities and the immediate diffusion of all events (lectures, guided tours, etc.), such as :

- the *Facebook Page* '@culturherDiploma2', dedicated to the Course on Cultural Heritage and created on the same date of publication of the call for applications: it served as a point of reference for preliminary contacts, immediate exchange of information, photographic documentation of the initiatives, etc.
- the *storage platform* in CNR cloud 'Pandora' for the exchange of didactic material (pdf etc.) with access password reserved for scholars and teachers
- *Online news*, offered by the institutional websites of IBAM, ICVBC, ISMA, ITABC and by CNR 'Press Office'.

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5.1 Course 3 Coordinator, Objectives and Results

SERGIO RIBICHINI

General Scientific coordinator of Course 3, on Cultural Heritage

in cooperation with the 4 Coordinators:

LUCIA ALBERTI (ISMA), **GIUSEPPE CACCIAGUERRA** (IBAM), **SALVATORE PIRO** (ITABC), and **HELENI PORFYRIOU** (ICVBC)



BIOSKETCH

To organize and manage the Course on Cultural Heritage, we formed a multi-disciplinary team, composed of a General Scientific Coordinator and four Coordinators, one for each of the Institutes involved in the project.

The Historian of Religions **Sergio Ribichini** is a former Research Director of CNR, and now Senior Research Associate for Cultural Heritage at ICVBC (<http://www.icvbc.cnr.it/Ribichini.pdf>).

Lucia Alberti is an Archaeologist and Researcher at ISMA (http://www.isma.cnr.it/?page_id=174).

Also **Giuseppe Cacciaguerra** is an Archaeologist and Researcher at IBAM (<http://www.ibam.cnr.it/2013-08-08-10-17-36/ricercatori>).

Salvatore Piro is a Geophysicist and Research Director at ITABC (<http://www.itabc.cnr.it/team/salvatore-piro>).

Heleni Porfyriou is an Urban Historian, Senior Researcher and Head of the Rome Unit of ICVBC (http://www.icvbc.cnr.it/cv/porfyriou_eng.htm).

Course Objectives

The main purpose of this course was to show the Italian approach to Cultural Heritage through a unique, interdisciplinary and multifaceted training program, planned in a harmonized way (areas and thematic fields, integrated methodologies, specific skills and competences), that often brought together some of the skills of the four participating institutes.

Results

The generous availability of CNR personnel (researchers and collaborators) made it possible to reach the expected goals and to promote the collaboration between scholars of different countries. Thus Italy may represent a bridge for sharing science and culture in relation to cultural heritage, aiming to create fruitful contacts with the institutions of origin of the scholars and establishing friendly relations among all participants.

The practical opportunities offered by the concomitant presence of three institutes at CNR-Montelibretti campus (with the general services and facilities offered, as i.e. guest house, canteen, conference room, shuttle service, laboratories, libraries, etc.), and the possibility to organize an important part of teaching (theory and practice) at other specific locations, such as IBAM in Catania and ICVBC in Florence and Milan, as well as in various archaeological sites (Cottanello- Rieti, of ISMA+ICVBC+ITABC, and Pani Loriga- Sardinia, of ISMA), offered to the fellows the great chance to be exposed to different methodological approaches and integrated technologies and to get acquainted with different geographical contexts.

A part of practical training carried and during the course 3, which especially involved the researchers of the CNR-ISMA, were concentrated on a series of activities, going from analysis of ancient materials to archaeological excavations (excavations at the Phoenician site of Pani Loriga, Sardinia, with Massimo Botto: <http://paniloriga.isma.cnr.it/>), visit of museums (Museo Nazionale di Arte Orientale with Irene Rossi: <http://www.museorientale.beniculturali.it/>; Museo Nazionale Etrusco di Villa Giulia and Palazzo Poniatowski with Laura Ambrosini and Alessandra Piergrossi: <http://www.villagiulia.beniculturali.it/>; Abbazia di Farfa and museum with Lucia Alberti: <http://www.abbaziadifarfa.it/>), foreign academies in Rome (British School at Rome with Lucia Alberti: <http://www.bsr.ac.uk/>; École Française de Rome: <http://www.efrome.it/>) and institutional centers dealing with the protection and management of cultural heritage.

At the end of the training course, the fellows were invited to propose possible joint research projects with institutes of their home countries involving researchers of the 'Diplomazia2' Programme, and to promote the establishment of durable international relations for a broad cooperation on cultural heritage.

5.2 Course 3 Fellows

JOLI MITROJORGJI

Albania



BIOSKETCH

I am a restorer architect working at the Institute of Cultural Monuments “*Gani Strazimiri*” in Tirana. I have an architectural education background. I completed my university studies in Tirana and a professional master in the “University of Navarra”, in Spain; also I was raised with the sensibility for cultural heritage and traditional architecture. My work is strictly connected to Albanian built heritage, from traditional architecture to historic centers and to archaeological sites.

I have traveled a lot in my life and I am developing my passion for photography and for exploring new places, their origins and history, especially in cultural heritage contexts in the Mediterranean area. I love reading, sun, animals and traveling, among many other things.

Why I have applied for Diplomazia2 and expectations

Diplomazia2 is a once in a life-time opportunity for young professionals and researchers whose work is directly linked to cultural heritage in the respective countries of origin. A program held in Italy, the cradle of civilization and with leading experts in the protection, conservation, valorization and fruition of cultural heritage.

My work at the Institute of Cultural Monuments, by the Ministry of Culture of Albania, gives me the opportunity to be a candidate for this intensive training program and my passion for this work gave me the right incentive to improve my professional skills and to challenge myself. My work is focused simultaneously in the processes of protection, conservation, restoration and management of the cultural heritage in Albania (from archaeological sites to historic centers, to singular monuments), meaning going from being a researcher, restorer, from policy making to the real action on the monument; that is why this program was an answer to my future professional goals. The opportunity to know and to collaborate with four distinct institutes working in cultural heritage such as ITABC, ISMA, ICVBC and IBAM, each one of them specialized on different aspects, is the chance for me to evolve, consolidate my knowledge and enrich my understanding to new approaches, new technologies and new methodologies applied to cultural heritage and more precisely to my field of interest that is the Mediterranean traditional architecture, the research,

policy making and management of historic centers, restoration techniques in the built heritage.

My expectations were focused in the capacity building in on a really professional level, in creating collaborative links between CNR researchers of the CNR and the Albanian research institutes operating in cultural heritage and open the way to future collaborations between them and the Institute of Cultural Monuments of Albania. Apart from creating a network between the two countries of the Mediterranean basin, this network can be extended also in to other countries that are represented in the program.

Diplomazia2 course on cultural heritage is a multidisciplinary program involving young researchers from different countries working in different fields. It is the perfect chance to overcome and surpass our limitations in the professional meaning where architects used to work only with architects, archaeologists with archaeologists, and learn to collaborate in a multidisciplinary way where each of us can give an important input in their field of expertise.

My experience as Diplomazia2 Fellow

The general framework of Diplomazia2, Course 3, on *Governance of Knowledge, Management, Conservation, Valorization and Sustainable Fruition of Cultural Heritage* involves four institutes working and acting in the cultural heritage field, such as IBAM, ICVBC, ISMA e ITABC. I was assigned to pass the first period of the specialization program at IBAM, in Catania, a multidisciplinary research institute with high expertise and specialized skills in the field of knowledge, documentation, diagnosis, preservation, enhancement, fruition and communication of archaeological and monumental heritage, and specialized on new approaches to cultural heritage management. This first period, from February to late March was focused on the didactic section on knowledge capacity building. According to this idea each of us was meant to establish scientific contacts with the researchers of the assigned institution. The didactic section was organized as a series of lectures mainly concentrated in funding the basic knowledge that would have been developed in the other practical sections of the program. We had lectures from the 4 institutes involved in the program, each one of them showing their experience according to their field of interest and specialization, such as:

1. IBAM: Roman and Medieval landscapes, remote sensing methodologies and technologies for enhancement and fruition of historical landscape, urban planning and urban archaeology of Sicilian towns from Greek period to period, archaeological and geophysical methods and techniques for diagnostic analysis of cultural heritage in urban context, GIS platform and Web-GIS systems for fruition of urban cultural heritage, ceramics and material culture from Hellenistic to medieval period, methods of archaeometric analysis for characterization of ceramics, digital methods and techniques for fruition of librarian heritage, platforms and immersive galleries for fruition of architectural and monumental heritage;

2. ISMA: Ancient Mediterranean history, archaeology and history in urban centers and archaeological sites, valorization and fruition in historical centers and archaeological sites, archaeological objects in its context, collecting actions: from private collections to the museum concept;
3. ICVBC: Integrated and sustainable valorization, archaeology and the city, theory and field work, preventive planned maintenance, cultural tourism and management of historic centers, materials and decay phenomena, non-invasive and portable devices, bench top instruments for micro-destructive analysis, conservation;
4. ITABC: Geophysical methods and techniques, reality-based acquisition methods and techniques, virtual heritage, theory and practice, sustainable conservation in historic buildings and city centers.

From the beginning till the 17 of April we continued all together the theoretical classes (after me and my colleague joined the group in Rome), combined with some practical field classes held mostly by ITABC researchers on application of geophysical methods and techniques applied on archaeology, photogrammetric acquisition, topographic survey, etc (Figure 5.1). Among the classes were organized field missions trips to Rome where along with our professors we had a very professional and detailed explanation (combined with visual understanding of the urban changes through the centuries, constructive debates and walking through Rome like never before, seeing it differently, getting to know the city) of its urban history from the its creation to modern times and mass tourism challenges when it comes to the management of the historic centre.

Practical activities started on the 17 of April with a sequence of trips all over Italy in the institutes of CNR to learn and practice on the methodologies used and the archaeological excavations.

The first institution who that welcomed us was ICVBC in Florence and in Pisa for 2 weeks, where we worked in the laboratory and had practical field work in the Abbey of Saint Miniato al Monte, where the researchers of ICVBC were at the time working with non-invasive techniques for restoration of the wall painting of by Paolo Uccello, discovering the color palette used by the painter, application of FTIR technology and spectroscopy, etc. We also had also the opportunity to make laboratory tests using the same technologies in the laboratories of ICVBC (Figure 5.1). We visited ICVBC in Pisa, where researchers focused their work, among many other aspects, in developing science and new organic materials applied to cultural heritage. We visited the *Opificio delle Pietre Dure* and had the chance to see some of the masterpieces they were working on. The second stop was in the ICVBC in Milan, when we had two days of field work on discussing on the decay reasons of stone material and conservation, focusing the first day in visiting places of interest where we could visualize this phenomena like *Saint Mary of the Graces*, *Monastery of Saint Maurizio*, *Palazzo Litta*, *Ca'Granda*, *Duomo Square*, *la Scala Square*, *Casa degli Omenoni* and *Saint Fidele Church* and the second day focusing

more on the type of stone material and causes of decay in the *Monumental Cemetery of Milan*, Porta Venezia quarter area o district with Art Nouveau decorations and artificial stone.

The second Institute we went to was IBAM in Catania. We were had many organized visits in sites where IBAM has developed several projects on material culture, urban archaeology applying GIS platform, 3D reconstruction, virtual tour technology, etc, combining theoretical, practical and site visits like such as the Roman Amphitheatre, Roman and Greek theatres, Diocesan Museum, “Achillian” baths, Benedictine Monastery library, underwater archaeology in Acireale and field visits to Syracuse at the archaeological area of Neapolis, Ortygia, the complex of San Giovanni and the catacombs and the archaeological museum of Syracuse.

The third institute to welcome us was ISMA, more specifically we had to participate at in the first archaeological mission of 2017’s campaign in Phoenician-Punic settlement of Pani Loriga, in Sardinia (Figure 5.2). Almost 3 weeks of real practice and experience of the work of an archaeologist, starting from the living style and daily discipline, to learning the process of work in an archaeological area from the beginning of the preparation of the site, to the process of cleaning, to the process of excavating, documentation, studying, topographic survey, analyzing, cleaning ceramics and drone survey of the site. It was the period where when we could connect lots of the didactic knowledge to practical work (Figure 5.2). The site collaboration with archaeologists was very fruitful even if we had basic knowledge, because they taught us, they mentored us, they made us part of their professional environment in all aspects. During this period, apart from the archaeological work, some field trips were organized in order to present us the archaeological significance of Sardinia. We visited Sant’Antioco’s island, archaeological museum Ferruccio Barreca, tombs of the giants, Nuragic settlement, tophet area, etc. The second trip was at the archaeological museum in Cagliari.

The forth Institute to host us was ITABC in Area di Ricerca 1 in Montelibretti, in Rome, where we are having practice on topographic survey, usage of total station, digitalization process and musealization new approaches. A combined tour in integrated surveying techniques, geophysical investigations, multidisciplinary approach for conservation and virtual heritage in field visits such as in Vatican Museum, Roman villa in Cottanello, Villa Giulia (Etruscan museum), Barbarano, Cerveteri and the restoration work in progress in Palatine Hill (Roman Forum), among many others.

Also during this time we had the chance to know other institutions working in the field of cultural heritage such as EEHAR (Escuela Espanola de Historia y Archeologia), BSR (British School in Rome), French Academy, ICCROM and many more.

My experience in Diplomazia2 cannot be told reported in a few words, as it is very challenging and of course there is a it is the risk of leaving out so many parts, not intentionally. I cannot avoid starting by putting the emphasis on

knowing Italy like never before, and by Italy I mean from Sicily to northern Lombardy. The only way to remember all of it, was keeping a travel diary of places I visited, personal impressions, things worth remembering and people I met. First month in Catania, Sicily was quite an interesting period. I was amazed by the magic of this island, that by all meanings differs quite a lot from the rest of Italy. I didn't lose the chance to visit it as much as I could, cities such as: Catania, Syracuse, Palermo, Noto, Caltagirone, Taormina, etc. I can definitely say that Palermo is the city where the fully Sicilian culture gets to you, which had a magic impact on me. I have visited (during the program and on free time) a lot of other cities such as Firenze, Milan, Sienna, San Gimignano, Rome and Cagliari, or archaeological sites such as: Cerveteri, Barbarano, Cottanello, Tuscolo, and the list goes down much more. I cannot leave without mentioning the little Italian *borgos* (the famous small Italian historic centres), places that amazed me by their urban structure, their architecture and their people.



Figure 5.1: a) Field practice with ITABC in geomatic module- GPS/GNSS systems; b) Field practice with ITABC in Geophysical methods applied in archaeology; c) Field practice with ITABC topographic survey using total station; d) Photogrammetry practice in the laboratory with Roberto Gabrielli of ITABC; e) Practice on site in Abbey of Sant Miniato in the Mount, with non-invasive techniques on wall painting; f) Laboratory of ICVBC in Florence



Figure 5.2: a) Archaeological mission in Pani Loriga, Sardinia b) Archaeological mission in Pani Loriga, Sardinia, excavation, documenting, surveying; c) Visit at the archaeological museum of Santadi



Figura 5.3: My experience in Italy photos

Among the theory theoretical part, field missions, practice, visits, etc. the moment I can easily distinguish from my experience in Diplomazia2 is the participation in the archaeological mission in Sardinia with ISMA. I really enjoyed working with the archaeological mission team, being part of that community of very interesting people, sharing experiences, histories, laughs, exhaustive moments and beautiful ones too. It was a period where work, practice, knowledge, leisure, fun and amazing people combined in a very natural and perfect way.

It is not something that happens to you every day do to visit mount Etna in eruption, or when by night you can enjoy the eruption of Etna from your terrace in Catania, or the Sardinian beaches, or see Michelangelo's, Botticelli's, Raffaello's masterpieces, or visit the most important museums all around Italy? Well, I did, and I am thankful to whoever was with me in this journey, my colleagues, the researchers, who are becoming friends from whom I learned from, I worked with, I shared and I enjoyed every moment during the way.

How diplomazia2 can improve my future perspectives

Diplomazia2 is a program focused on cultural heritage. It is a very intense professional training program touching many aspects on how to deal with contemporary challenges of heritage, from management, restoration, research, valorization and fruition. This program facilitated me with a higher level of knowledge on the up-mentioned topics, giving me the opportunity to have higher qualifications that willingly can favorite my future as a researcher with new combined methodologies involving different disciplines leading to a more structured approach when working on cultural heritage. I would feel privileged at the fulfilling of the course to assimilate correctly most of the training and to apply it in my daily work. Diplomazia2 has equipped me with all the necessary tools, techniques and methodology to be a researcher. Now I feel a step closer to reach one of my professional future goals.

I am finishing this course with a much bigger panorama of knowledge on different fields, applied sciences, techniques and methodology, enabling me to face wider and more complex challenges and finding new scopes of research to apply in the context of cultural heritage of Albania.

During this 6 months period, I was able to know many institutes, many researchers and their work, something that gives me a great network of contacts for future collaborations creating the bridge between the CNR and my institute of origin. I had the chance to present Albania and its cultural heritage, the differences and the similarities we have. Along with the course way we have worked together with the researchers to keep enriching the network and the collaborations even for the future creating a functioning network between countries, institutions and researchers.



BIOSKETCH

I applied for DIPLOMAzia2 following the politics of work in my university for postdoctoral lecturers and, as such, I decided to take on a sabbatical from lecturing which was carried on at the Department of Applied Social Sciences, European University of Tirana. I hold a PhD (2015) in cultural anthropology at the Babes-Bolyai University in Cluj-Napoca. My PhD project focused on social anthropological exploration of Albanian Vlach minority and their ethnic interaction within the Albanian southeast realm. The project specifically focused on dynamics of change in the society and traditional music (polyphony) in southeast Albania after the fall of communism.

My research interests include intangible cultural heritage, spatial and societal matters; local and collective identities in southeast Albania, narratives on oral history, folk songs, communism and post-socialism matters, linguistic, ethnic and sexual minorities. Since 2012 I founded and still carry the position of Executive Director at the non-profit organization Action Center for the Survey of Cultural Dynamics and Cultural Interactions (ACSCDCI) with focus on the development of cultural interactions. In 2008 I also became a founding member of the Center for Albanian Studies in Albania and have been working there as a researcher, at the Institute of Cultural Anthropology and Art Studies (CAS). My research experience dates back to 2003 when started working as a researcher at the Institute of Folklore Studies, an institute of Albanian Academy of Science.

My professional aim is to enlarge the academic network (one of the many reasons I am in Diplomazia2) and so to be member of various scholarly societies too: International Association for Southeast European Anthropology (InASEA), The European Association of Social Anthropologists (EASA), Association for the Study of Ethnicity and Nationalism (ASEN), UNESCO. I have participated in local and international conferences and have published in Albanian and international academic

	<p>journals, collective volumes in Albanian, Serbian and in English, on topics relating to her scholarly interests. During my research path I have been awarded by several grants and awards: The Civil Society Scholar Awards, Open Society Foundations (2014-2015) (DECLINED); Global Supplementary Grant Program, GSGP Europe and European Studies Program, Open Society Scholarship Programs, Open Society Foundation – London, (2013-14), (2012-2013), (2011-2012); “Award for International Scholars”, Institute Cultural Roman, Ministry of Foreign Affairs, Romania (2012-2013).</p> <p>Anthropology and cultural studies interact also in my everyday life in which aspects of society, incessantly involve my observation, my participation in social events and analytical approach. The fluidity of the line between profession and every-day life affects personal relationships where informants or colleagues may become also friends. I enjoy spending time and socialize with people, particularly listening to life stories of individuals, families, or places, myths and legends from different places. In this context I like academic or touristic travels, getting to know places and people, their culture and tradition.</p> <p>I am an animalist, adore spending time with pets and other animals. In the same frequency of nature contact, I enjoy climbing mountains, playing tennis and practicing yoga. Western and Eastern classical music, also jazz fill up the hours of music listening and when I find some time I play flute a wide range of music areas.</p>
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Why I have applied for Diplomazia2 and expectations

Having developed gradually over the time my academic interests in socio-cultural anthropology which are oriented toward politics of culture, and politics of cultural heritage on a national and supranational level, my research interest is dedicated to cultural minorities, their stories and identity origins. Spaces embody values and narrations of identity of both tangible and intangible culture. Hence, my research focuses on people and on cultural landscapes and historic (Medieval) cities where historic buildings, monuments and archeological areas, are the absolute center in the identity and cultural policies of the Vlach minority (the case study I concentrate my research on).

Since a decade I have been working on Cultural Heritage discipline with focus on intangible heritage. As a practice of the research institutes where I have been working, I was involved in investigating intangible aspects of Albanian tradition. Also I was involved in the evaluation and preservation of folklore (audio and video archive materials), by reproducing a digital archive, and, as a matter of fact, this is the solely digital archive of folklore existing in Albania.

I came to know about the fellowships at CNR and I had a good knowledge concerning Italian approach and mastery of cultural heritage management. I was totally aware of the school of conservation, the setting of a complete legislation to safeguard historic structures, sites and areas that Italy had formed in creating its own system and paradigm. Besides, I was familiar with the bilateral agreement between Albanian and Italian governments, that has predominantly generated a continuity of projects in the restoration of historic architecture. Under the guidance of Italian architects and archeologists coming from universities, research and conservation institutes, a considerable number of cultural and individual buildings underwent restoration, also archeological areas are yet under excavation process. Having the information about the Italian paradigm in cultural heritage I was pushed forward to enhance my knowledge in tangible heritage and to bring forward a new concept of correlating intangible and tangible heritage in management and conservation.

In my opinion as a cultural anthropologist, in Albania of present days, the primary objective in the conservation remains is just limited to tangible heritage, historic buildings, and urbanistic organizations. The lack of attention to intangible dimensions while achieving a conservation process, creates a problem in reconstructing a new identity of the place, which has no reference with the past. Conservation of historic areas in Albania should consider the close relation that tangible and intangible culture have in areas where collective memory is yet alive.

Particularly in areas where tourism is developing the overlooking of historical architecture, it sometimes transforms the identity of the space also in its aesthetic and functionality. The neglecting of cultural assets, the changing of the environment function removing people out and transforming the historical buildings in hotels, restaurants, shops, has affected the emerging of a new identity of the place. The problematic part remains the bad management of the heritage in which space and local people lose their sense of identity, and the role that heritage instead has in making a sustainable economic. Reality is not satisfactory. In this way, I am mostly concentrated in following the pattern of cultural heritage operating with the preservation of both intangible and tangible. Vice versa the two dimensions define the history of the community and nourish the narration of tradition.

My expectations from the program *Diplomazia2*, Cultural Heritage course when I applied were upgrading the understanding of cultural politics,

management principles and methods, the way conservation principles for tangible heritage focus on the improvement of quality and the protection and utilization of historical sites and buildings. The same approach can be used for intangible culture.

My experience as Diplomazia2 Fellow

The sector of Management of Historical and Cultural Heritage has its own specific approach which goes in parallel with cultural anthropology, which is, traveling, observing/diagnosing the research object and concretely working in the field/site. Once I was selected, I read the preliminary program and came to know about the numerous travels in Italy. As a non-expert on tangible heritage, I was going to attend most un-particular academic experiences. I was going to visit and analyse very closely illustrious museums, monuments, historical and archaeological sites and areas, national and international Academies that centre in archaeology, art history and history, international institutions of Cultural Heritage management, restoration and diagnosing institutions and their laboratories. These laboratories are world leader in historic sites, monuments and fine art diagnosing as well as conservation. They are devoted to diagnosing and conserving methods, innovation technologies and techniques which is called open innovation. The entrepreneurship relies in open collaboration with high-technology private companies, international universities and shared knowledge. The multidisciplinary collaboration makes up a long list of expertise; geophysics, geology, chemistry, physics, photogrammetry, archaeology, history, fine art history, cultural and physical anthropology, botany, zoology, architecture, engineering, photography, restoration.

The high level course included all the above mentioned disciplines which combined theoretical sessions with practical training, technical visits with research and documentation sessions, intermediate checking and evaluations, laboratory of restoration.

During my lectures at my home university, I always repeat to my students the phrase 'knowledge is power'. And here I was myself, immersed into a series of specific knowledge-acquiring in cultural heritage management. Thus, I was provided competencies and skills in preservation, and fruition that I could use once returned home. Scholars are somehow missionaries of cultures they deal with, affections and insights is an unavoidable fact. My duty is to intervene and fight the problems that time creates, but, also government people from neglecting human vandalism which occurs often in Albanian cultural heritage. With adequate theory, methodology and instruments, fellows during the courses took proficiency in recognizing and evaluating cultural heritage in sites, monuments, historical areas and artifacts as well their constitution material. Fellows, along with a set of laws and regulations, in macro and micro scale, learned to examine the risks that relate to object construction materials and to define the choices of preservation and maintenance. I had the

opportunity to approach with a new understanding, how to consider the possibility of launching and marketing, tangible and intangible campaigns; to design new quantitative databases that localize culture, to plan a management project for virtual exhibitions or museology and to identify the appropriate objects.

The acquired theory and methods took place in open spaces like historical areas and closed places such as; museums, monuments, libraries, laboratories in Roma/ Rome, Sicilia/Sicily- Catania, Siracusa/Syracuse, in Firenze/Florence, Pisa, Milan[o], in Sardinia-Cagliari, Santadi, Sant' Antioco. Diplomazia2 adventure first destination was Catania. Both of us, the two members of the program were assigned to IBAM. IBAM locates in the headquarters of the University of Catania, formerly the building was a Benedictine Monastery of San Nicolò l'Arena. The monastery is a Sicilian baroque style where architectural stratification leaves traces for historical evidences. At present days it makes part of UNESCO World Heritage.

We entered Catania right the last day the religious festival of St. Agatha had ended. The next day the candles wax could be seen all over the city Centre. From the slight lay of wax that partly appeared on streets and pavements, a visitor could track the crowd marching behind the city patron that crossed in the Piazza Duomo and Via Etnea. My regret during the month spent in Catania followed with repetitive claims, "A misfortune, to miss one of the largest traditional feasts in Sicily and Italy. I am here, I hear people narrating with enthusiasm and pride about the legend of St. Agatha and the folklore elements of the celebrations. I see the cult reference buildings, the shrines, spots and streets where the procession crosses but I lost the possibility to participate in the festivities!". One could obviously perceive that the presence of the volcano Etna and the cult of St. Agatha were fundamental for the collective identity of citizens. A mutual interaction puts the both in tangible and intangible heritage of Catania.

The Volcano has a decisive role in the city history formation being identified also, an Etna territory.

The continuous threat of the volcano erosion along centuries had created countable disasters in the city and as a matter of fact, the lava flows have influenced the dynamics of the city morphology by transforming the urban space in different time periods.

St. Agatha figure is a response to the disasters that the volcano has created in the Middle Ages period. Likewise her own story, she is a gender symbol of protection of violated women, but in considering her bleeding wounds it can be directly connected also with the red lava coming out from the eruption of the volcano. The creation of the religious cult and the veneration is a passage of paganism practices into early Christianity, where the need for protection from an alternative force emerges against the natural phenomena.

The city keeps alive the mythical figure in different forms of practices, from the dedicating of churches, fountains, museum to the most illustrious object, the

cathedral of Duomo. Worshipping is very strong, that in a church script says that Catanian citizens are considered Aghatha's nation.

Indeed, Etna and St. Agatha are a social, spatial and financial capital for the community and the city. It is why the cultural heritage of the city stresses on the interdependence between intangible and tangible culture.

Catania, a city with a commercial seaport, is a city with ethnic and cultural diversity, influenced from multicultural flows and mainly oriental culture. For this reason the citizens are very opened to the new comers. I was able to socialize with people everywhere, as the personality of the citizens is warm and highly communicative. And as an anthropologist I was easily accessed to the facts of the city's reality.

At first I was expecting from citizens a strong relation with the Ionian Sea which is a source of financial profit for tourism and trade. This is what I envisaged about a coast city comparing my Albanian experience and the strong relation that Albanians who live along the Ionian Sea have. But the eyes of citizens and the history of the city are mainly focused on the Etna Mountain.

Catania is a city attached to aesthetic engagements: the overlapping of time in architecture with limestone and black lava stones, the commemorating features that leave sign on the Catania origin of artists like Vincenzo Bellini and the verist writer Giovanni Verga, the all colorful folklorist fish market 'A Piscaria' at the heart of the city center, break out the frame of the theatrical scene descending from the stage into audience. And these incorporation that extend to art and non-art, materials and practices, they reach out a surprising development on aesthetic aspiration and demand to the visitor active participation in the customary process.

Via Etnea, the main shopping street connects with Piazza del Duomo, on a daily basis are the commercial, social and cultural hot spots of the city. Artistic activities mingle with artifact expositions and popular culinary served as street food in 'tavola calda' are available in coffee shops and bakeries. My alluring evening walks along the city center, in Via Etnea, are a remarkable experience. The view of mount Etna that stands at the end of the street, the tasting of a warm *arancino* or *crispelle*, accompanied in the background by the sounds of street musicians thrived from little pleasure of the dog evening walking make a winter-spring time a total living stage.

Our second destination was Rome. We headed to the central headquarters of Consiglio Nazionale delle Ricerche/National Research Council (CNR), research area 1 of Rome that is located in a suburban area in Montelibretti. CNR is the main public research institution in Italy under the Research Ministry. It performs multidisciplinary research activities and has numerous institutes and labs nationwide. The Cultural Heritage Institutes of Diplomazia2 program are affiliated to the department of Social Science and Humanities, and Applied sciences for Cultural Heritage: IBAM, ISMA, ITABC and IVCBC. The research area is a construction built between 70-80s of 20th century, and the area, at a first sight resembled to me a military installation. The area is surrounded by

nature and vegetation which makes the residence comfortable, pleasant and of course calm for study.

After almost 2 months of distant contacts from Catania, my colleague and I had the possibility to meet with researchers of CNR in Rome and the rest of Diplomazia2 fellows. As the group had to reunite, all the practical courses were postponed until our arrival in Rome. The course lectured from Dr. Heleni Porfyriou (ICVBC) with topics 'Reading the city' or 'History and city' were a mixture of urban anthropology and historical anthropology. Certainly, these lectures along with those on virtual museum presented by ITABC scholars, when analysed and presented in site were my first choice from the Diplomazia2 program. I had no possibility to observe the anthropological side of Rome, apart catching the Roman dialect and some idioms. Traditional events that I could experience were part of cultural politics, implemented in recent times in order to enhance the economy of less developed areas. Rome is a mainstream cosmopolitan city, with a massive focus in consumerism, the use of culture, the city centres around the wellbeing 'la bella vita'. The culinary art and the magic architecture of ancient Rome, certainly spoils the tastes of a visitor.

If a scholar gets affiliated to a CNR institute, particularly if the work is connected with ITABC, amities and good food will be offered every moment.

Our third stage of travels headed to Tuscany/Toscana, attending a range lectures at ICVBC headquarters that locate in Rome, Florence/Firenze, Pisa and Milan. We had a warm welcoming from researchers of ICVBC in Firenze, and these considerations marked my impressions about Tuscany citizens. For those few days I spent in the region, I had a good empathy with researchers of the institute. We conversed a lot and our talks jumped from academic topics to social life in Tuscany. Building a positive relation with researchers and citizens of the region was a precious experience, it helped me remove the prejudices about the ethnocentricity of the society. In addition according to my experience an innovative approach of restoration and diagnostic was offered. With no doubts, researchers at CNR institutes are few of the best restorers in the world. A researcher lacking modesty once told me, "We Italians, are the best in the world for cultural heritage". Indeed, the scholar was not wrong on self-evaluating the Italian paradigm, in how it is operated in management of sites, historical buildings and conservation. And the facts speak for themselves.

In Firenze and Pisa ICVBC laboratories, I came to know that modern art comparing to the ancient and renaissance art is quite difficult to be preserved. The industrialization and modern fabrication of materials has reduced quality and this fact affects in a rapid deterioration of objects. And in these labs, fellows of Diplomazia2 could have the opportunity to make time simulation tests applying on industrial materials.

As the mission directed to visit all ICVBC labs, after Firenze and Pisa we headed to Milan.

Milan was going to be an open area laboratory, under the direction of Dr. Antonio Sansonetti and Dr. Roberto Bugini, we observed Milan monuments, and the material decay and conservation. The combination of theory with

practice were concentrated in the city centre of Milan. Through the practical work the group observed monuments materials, and could also explore the dynamics of construction, the use of material and working across time. Our little field work focused mainly on the elite lifestyle of Milan society starting from the 19th century Liberty (Arte Nuova/Art Nouveau) architectural style to the most contemporary buildings. We had the opportunity to make also a small anthropological survey jumping from death and life neighbourhoods of Milan. We visited the Monumental Cemetery [Cimitero Monumentale] with its impressing art pieces and sculptures and in a later time we visited the life area, scanning the architecture and materials of the majestic and charming palaces, courtyards and streets of Liberty style.

Sardinia experience in the small town of Santadi had a unique and solely flavour. Social and cultural dimensions in Sardinia detach the place from the rest of Italy. Its citizens have a strong connection with the island, which reflect to have constructed an island identity, and their sight is on move, versus Italy 'the continent', Spain and more East. This is where their culture originates, from multicultural influences of Phoenicians, Romans, Vandals, Byzantines, Spanish, Italians. As seen in the place, today make the pillars of the island identity. Sardinians have their language, it is not a dialect, and they practice their amazing and rich customs; the mastering of bread preparation and particularly its decoration, the cheese variations, the polyphony singing 'cantu a tenore', the religious feasts, the traditional costumes, etc.

The nature is wild, and the soil is full of minerals. It is said that Sardinia is the first place in Europe with the richest mineral soil. And one can observe these claims from its fertility and the polychromic stones. And this is one crucial item why Phoenicians colonised the island.

I was amazed of the megalithic constructions named nuraghe [nuraxi] and the tombs excavated in the rocks. Also the ancient art of Nuragic and Punic civilizations resembled masterpieces of contemporary art. As a matter of fact, modern painters have borrowed much from the style. Like the most articulated case of Amedeo Modigliani, who spent his childhood in Sardinia. I could easily connect with people and getting into their traditional family stories, as Sardinians are very warm and hospital. In this way, they resembled much with Albanians. And as a matter of fact, also the rocky coast with its coastal villages looked to me like a clone of Albanian Ionian seaside.

Pani-Loriga archaeological site close Santadi was Diplomazia2's next work. The mission was directed by ISMA and the leading archaeologist who worked for a long time was Dr. Massimo Botto. We excavated in a Phoenician-Punic habitation. We spent almost three weeks digging, excavating, preparing identity files and putting in notes on each strata and step of work. Our duty was to relief the object and the dwelling from the soil and ground. At the end of the mission, it was quite satisfactory seeing that the hard work my colleagues and I had made, resulted on nothing. Hm. Our area consisted in opening the space of the dwelling entrance. But, a slight satisfaction was left from the time, we were lucky to find some fragments of pottery.

In any case, thanks to this direct experience I could distinct some differences between cultural anthropology way of working. Archaeology integrates high systematic methods, and the structure of an archaeological mission is strictly hierarchical.

How diplomazia2 can improve my future perspectives

The above mentioned multidisciplinary package of knowledge with a wide range of methods I received in the fields of cultural heritage evaluation, preservation, and fruition, I am enthusiastic to invest in Albanian academia. At first, I am interested in settling a network between CNR scholars and Albanian institutions for developing future projects. Secondly, I am interested in pushing forward the positive opinion Italy has toward Albania concerning the application of sustainable projects. Will Diplomazia2 improve my future perspectives? Certainly so, the quantity of knowledge and enhance of understanding has prepared me to be a professional, employed in Cultural Heritage matters. I still don't aim to improving my career perspective whether I will have an important diploma from a world leading institution. I live in a high corrupted social and political context where nepotism and politics affect individuals' careers. But, as I always say 'knowledge is power', and I am confident that Diplomazia2 diploma will challenge once again the Albanian system. Actually, I hold a teaching position in one of the best Universities in Tirana. The objectives of the University are to integrate the most innovative approaches and theories and apply them in projects. I am very keen to bring in Albania CNR expertise and develop projects, with different governmental and non-governmental institutions, with the intention to optimize cultural heritage in my home country.



BIOSKETCH

I am a historian from Montenegro. After obtaining a Bachelor's degree at University of Novi Sad in Serbia, I continued Master studies at the same University. As I was interested in Middle Ages and especially in connections between cultures and civilizations in the Mediterranean during the Crusades, I chose such topic. I obtained a Master's of Arts degree after defending thesis "Frederick II Hohenstaufen- A medieval renaissance Emperor". This year, I am starting PhD studies at De Monfort University in Leicester, England.

I am curator at the National Museum of Montenegro-Historical Museum. As I was working on contemporary history while preparing permanent exhibition at the Museum, I got more interested in the 20th century balkanic history. This is why I will be working on a cultural and social issues in the Balkans while on PhD.

I enjoy travelling and discovering new places. Staying in Italy for this program gave me the opportunity to see and experience so much. Music is my great passion. I play piano and love going to concerts, be it classical music or rock festivals.

Why I have applied for Diplomazia2 and expectations

A friend of mine, a former Diplomazia1 participant, told me about this program. I didn't need to think twice about applying. On one hand, it was an amazing and unique opportunity for carrier development, and on the other, the idea of spending six months in this wonderful country seemed too appealing. I was eligible for Diplomazia2 Course 3 on Cultural heritage. The idea of Course 3 is to connect people from different professional backgrounds, but connected to cultural heritage, from all over the Mediterranean, to get them together to join their knowledge and learn from experts and researchers at CNR. It is a well-known fact that, when it comes to cultural heritage and its preservation, valorization and promotion, the Italians are top in the world. So, for a curator from a Mediterranean country, interested in Mediterranean and Italian history and culture, this Course sounded like a perfect opportunity. And indeed it was. During these six months we were given the chance to learn about

different techniques, possibilities, an above all multidisciplinary approaches to dealing with heritage, both tangible and intangible. Moreover, I knew that I would benefit from this Course not only as an individual, but also I knew that this was the opportunity to bring some new ideas to my workplace, to the Museum. I could enrich my knowledge, meet new people, see how things function in Italian institutions, and travel around the country, and at the same time I wanted to use all this new experience to make some changes in my work place, and possibly to connect main cultural institutions in Montenegro with Italian ones. Knowing that this Course could offer all this, I filled out the application.

My experience as Diplomazia2 Fellow

Course 3 of Diplomazia2 was conducted under four CNR Institutes: ITABC, ICVBC, IBAM and ISMA. All participants were assigned to one of the Institutes according to their professional background and preferences. Seven of us, all with different interests and degrees, but at the same time, all connected, in one way or another, with Cultural heritage. I was assigned to ISMA. Lectures were given by the professors and researchers from each Institute during this time. The idea was to bring us all together in order to give us the opportunity to see and realize how many different aspects and approaches exist for dealing with cultural heritage. These Institutes are all very different but also similar, sharing the same goal. It is the same case with us- we are architects, physicists, chemists, anthropologists, archaeologists and historians. It seems as if we have nothing in common, but if we put our knowledge and experiences together, we can make a great team. We actually understood it during these several months.

We arrived in Italy on February 6, and after first few days spent on administrative formalities, we began with lectures. For the first two and half months we had various types of lectures in CNR Area di ricerca di Roma a Montelibretti. As I decided to live in Rome for these six months, I travelled every morning by train to Montelibretti. Attending the lectures, with a range of topics- from Ancient Mesopotamia, to Georadar, GPS, GIS, Underwater Archaeology, Stone Conservation Methods, Urban Planning, Virtualization and so much more, we got to know that Cultural Heritage needs a multidisciplinary team, and that there are many ways of approaching to its preservation and promotion. It was great to have been given the chance to appreciate it and understand it because, unfortunately, in our countries that is not always possible. Or we are not able to see it in that way. However, this Course, these lectures, opened our horizons to whole new world of opportunities, ideas, possibilities. I have to admit, it wasn't always easy. It was overwhelming from time to time to listen and to be able to follow different lectures. As a historian, I had many difficulties understanding and being able

to follow classes about geophysics or chemicals applied on stones. Other difficulty was that, due to CNR regulations, two other participants were in Catania, and not with us, so lectures were given also via Skype, and we couldn't have the practice without all of us being in the same place. That is why sometimes it was very hard to follow theory, and not being able to see it in practice. But we had practical part of our lectures after March 20th, and in this case, all of us were in the same place, in Montelibretti. Then we were given the opportunity to visit the laboratories and perform experiments in order to examine diverse qualities of certain materials. In a field near ITABC we performed geophysical measurements using Georadar, Total Station, GPS, Laser Scanner. Those are instruments that I never thought I needed in my life. However, it turned out, we could do nothing without them, be it archaeological mission or protection inside urban walls in the cities. Archaeology needs technology, technology needs architecture, architecture needs history. It is as simple as that.

Whoever devised the plan and itinerary for Course 3, we need to thank. We were given the perfect and unique opportunity to travel across Italy, see so many places we would have never visited, and experience things we would have not been able to do by ourselves. For a month and a half, we combined work and learning with travel and pleasure, and it was wonderful.

Because ICVBC is not centered in Rome, and main Institutions are in Florence and Milan, we went there. And after that, we went to Catania, to IBAM center, to finish all with ISMA archaeological mission in Sardinia. This "Giro d'Italia" was truly an experience to remember for a lifetime.

For 10 days in Florence we were based in ICVBC laboratories, but also had several field trips in the historic centre. There, we were given lectures and opportunities to perform experiments with their researchers. Main focus was on stone conservation and protection on monumental buildings and cultural goods. We were actually given the possibility to do in situ experiments in spectroscopy in San Miniato al Monte Church. One day we went to Pisa to meet the director of ICVBC, see its laboratories and had a visit to Piazza dei Miracoli. Special delight for me was a visit to Opificio delle pietre dure, a leading institution in the world when it comes to conservation and restauration of world's most famous and valuable artifacts.

In Milan we spent 3 days, having wonderful tours around the "fashion capital". But we skipped the Quadrilatero della moda, and explored Liberty style of Milanese buildings, Santa Maria delle Grazie Church and Duomo. We saw important Cimitero Monumentale and quite unexpectedly, flamingos in one private garden.

Then we packed our bags and left rainy and cold Milan for some sun and granitas. Two weeks in Sicily. One could not ask for more. Especially me, whose Master Thesis dealt with Sicilian king and Sicilian culture in the medieval period. As it was not possible for me to go to Sicily before, this was indeed like a dream come true. Every day magnificent Etna greeted us and reminded how this beautiful city depends on its mood- on every corner you could see petrified lava that witnesses the fate Catania had during history. It was possible to see it on monuments: Castello Ursino was once on the cliff above the sea, now stands in the center of town. Friendly IBAM staff focused on archaeology and history. They took us to see Roman and Greek theatres tucked and secluded in the very heart of the town. Combination of theory with field trips to Siracusa and Aci Castello was the right thing. Since the weekends were free, we were able to make trips to beautiful Palermo and Taormina.

Last but not the least was Sardinia. We were supposed to spend 15 days in a small village called Santadi and to participate in a mission on Phoenician-Punic site of Pani Loriga. Archaeologists and historians always have disputes about which science is more important, whose work is more important. That is why I always said that Archaeology was just an auxiliary discipline to History. How wrong I was. Those two weeks while I was Indiana Jones, working on this site were unforgettable. I had Archaeology classes at University, and could not say I liked it very much. We didn't learn how the excavation was actually done. How all this complicated work was divided into. How archeological team functioned. We couldn't know about the excitement and unbelievable happiness that runs through veins when you dig something from one "strato", one layer of soil. It was hard work, from dawn until late afternoon, but I wouldn't change it for a day. Our team functioned very well - from digging new layers, measuring with Total Station, filling documentation, to washing ceramics and taking pictures with a drone, to cooking lunches and dinners and going to the beach all together.

Now we are back to Rome. These last couple of months we shall use to enjoy some more the Eternal City, to visit with people from CNR archaeological sites and villages (borghi) in Lazio, Vatican and other museums and institutions.

Lastly, another thing that I would like to stress is people. Italians are known to be very friendly, and this was no exception. They were very open and willing to help us, tell more, and if we needed anything, they were there. In the end, we became friends with a lot of them.



Figura 5.4: a) Lava stones in Catania; b) Class about digitizing manuscripts and books in Catania



Figura 5.5: a) Square Federico di Svevia-Frederick II, my Master Thesis subject, in Siracusa; b) Drone picture of our team in Pani Loriga; c) Washing pottery in Pani Loriga

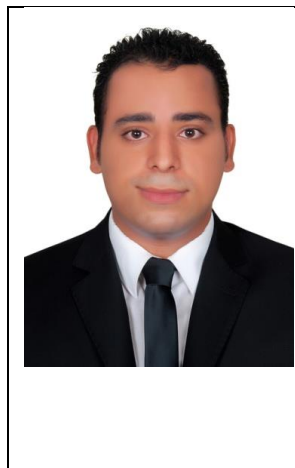
How diplomazia2 can improve my future perspectives

Being a Diplomazia2 participant was great and significant, and an injection boost to one's CV, because it demonstrates that the person has been recognized and given trust by a leading Italian research institution such as CNR. It is also an evidence of the experience and knowledge we gained during these six months, which we would implement in future. I will start my PhD studies this year. As I applied for these studies while being in Italy, this Course was very

important for my application. We do not have to focus on only one thing in our careers- from medievalist to curator to contemporary historian and in the meantime came Diplomazia2 with all its different opportunities and skills, it is going to be very interesting and busy schedule for me in the future. The diversity and broad field of interest of this Course mean that we are now familiar and equipped with new skills. I am referencing here mainly to the use of GIS, GPS and Total Station which are now used worldwide in every field of science, and yet in our countries there are very few people using them. Especially in cultural heritage. Another important thing is that I now have a little experience in archeological practice and missions, which for me it means that I could go on archeological surveys with colleagues from the Museum because attending this Course made me the only historian in Montenegro equipped for going "in the field". I have met many wonderful and professional people in Italy and that also opens the door to possible future projects and collaborations. I could also apply for other archaeological missions and probably I will. However, the end of Diplomazia2 course certainly doesn't mean the end of cooperation. We all came to Italy with at least one idea for future possibilities. As I am working in a museum, from the start I had the desire to connect my institution with CNR. During the Course I developed several ideas of possible joint work with CNR experts. Cooperation between CNR and Montenegro has already been fruitful as we now have an ongoing project on Doclea, Roman and medieval site. This project is a direct result of Diplomazia1. I really hope that there will also be successful cooperation and job possibilities after Diplomazia2. So, on one hand, I hope to encourage collaboration between CNR and the National Museum of Montenegro, or other cultural institutions in my country, on the other hand, I know that for me personally, attending this Course brought up many new possibilities and gave me ideas for future works.

MINA MAGDY

Egypt



BIOSKETCH

I have a Bachelor's degree in chemistry and zoology (Double Course), and Diploma degree in biochemistry and physiology. I received my Master's degree in analytical chemistry from Cairo University. I have registered for PhD degree in analytical chemistry at Cairo University. I am familiar with spectroscopy, imaging, chromatography and thermal methods. I work as a chemist at the National Museum of Egyptian Civilization (NMEC). I am responsible for analysis of the artifact samples and assessment of the objects as a result of the normal aging or the environmental conditions.

Why I have applied for Diplomazia2 and expectations

I have applied for a fellowship within Diploamzaia2 because it is a good chance to obtain experience from a good research institution (CNR). Traveling abroad, having contact with experts in my specialization, improvement of my skills, increase of my knowledge and creating new relationships for future collaboration are the reasons to submit for the fellowship.

My experience as Diplomazia2 Fellow

Course 3, "the cultural heritage", was a program of academic lectures, field trips, laboratory activities and field work. In addition to living in Rome, travelling to visit CNR institutes in different cities; Florence, Milan, Catania and Sardinia have been performed. The course has included information about different types of archaeological materials and their deterioration, the chemical and physical techniques, the topography techniques, the geophysical techniques, the photogrammetric and laser scanning and the historical background about the ancient civilizations. The content of the course gives a general picture about the work in the archaeological field. The new information grows new ideas which can convert to new applications. The six months course was a good chance for more contact with different cultures and habitats, for making friends from other countries and this contact gave a lot both to my scientific and personal life.

I agree with the statement "know everything about one thing and know one thing about everything". The multidisciplinary approach of the program was very good to obtain new information about the numerous sciences and get to know the nature of works which could complement the processing of the

research work. From my point of view, it is better to focus on one specialization and determine the time to improve the skills of the researcher in his/her field. All things considered, there can be a short course including the implementation of the other sciences. My work is about applying the analytical techniques for characterization of the archaeological objects. The course had included visiting of the chemistry labs, seeing the methods used in the archaeometry work and meeting high-qualified experts. Consequently, it was better to focus my time, knowledge and experience in my discipline. Based on that, I could share with them, methodology of the chemical analyses and publishing of the research articles.

Thanks to all coordinators of the program who created a good environment within the program. Greeting to all CNR staff who have welcomed and helped us during all the steps of the program.



Figura 5.6: Pictures during Diplomazia2 activities

How diplomazia2 can improve my future perspectives

Fellowship of Diplomazia means “Diplomacy of science”. Scientific cooperation between the countries could build a good relationship between them. Science can tackle the challenges and open new opportunities for work. A good relationship among all researchers, alumni and professors could translate into collaboration in the future.

Regions of the Mediterranean Basin have an impact on the culture and habitat transfer, so it is worth to increase communication between the countries. New policy and new scientific language in the cooperation between countries can improve the diplomatic relationships and open new opportunities of working to have impacts on the conditions of the countries. The implementation of new projects between the two partners, Egyptian and Italian, can lead to perform research work to present data able to benefit society. According to that, scope of the program is seeking to create a bridge between the countries through science.

Conduction of new projects, workshops or conferences can be some of the activities between Egyptian and Italian scholars. For instance, there can be a joint project between Egypt and Italy for archaeometric study of the historic sites and the study could include two steps within documentation and preservation disciplines. Documentation step involves topography, geophysical, history and digitalization issues. Preservation step involves conservation and restoration of the artifacts using different chemical techniques. The results of the work are preservation of the cultural heritage, promotion of visits to archaeological sites, encouragement of tourism and increase of the countries' income. During the work, there will be an exchange of experience between the teams, work in situ, experiments and interpretation of the results. Processing of the work will include publication of articles on the research for crediting the work. The cooperation will improve the qualifications and will support the career development. New scientific cooperation is a new step for further steps towards international collaboration.

MOHAMED, MOHAMED MORSY

Egypt



BIOSKETCH

Mohamed is researcher at Building Physics Institute, Housing and Building National Research Center (HBRC), Giza, Egypt. He obtained his PhD in solid state physics from Al-Azhar University. His professional interest focuses on Nano materials and its applications in construction sectors and gas sensors where he established the Nano-lab in his institute. In addition to his work as a researcher, he serves as quality manager in his institute and also works as part time lecturer in a private university. He started his career as researcher assistant at National Research Center (NRC), Egypt where he spent three years, and then moved to HBRC in late 2009. His previous professional experiences include metallurgy where he obtained his MSc from Helwan University in metal physics focusing on age hardened Aluminum alloys. Mohamed has talent and passion in design and fabrication of scientific instruments like gas sensing test system and chemical vapor deposition system used during his work in PhD.

Reading, visiting and discovering new places, listening to classical music, home appliances and electronic instruments maintenance, represent important hobbies to him. He likes to practice walking and fitness in the morning.

Why I have applied for Diplomazia2 and expectations:

The first reason is the possibility for me to work in another country and experience another way of living. I imagine immersing myself in another culture with a different history will be a lot of fun and a good formative experience. In the same context, overcoming the borders between different cultures leads to develop and refine personal skills and that's exactly what I seek. The second reason is related to CNR itself; because I have always desired to work in a successful, and innovative environment. The good reputation of Italian researchers worldwide in the field of cultural heritage encouraged me to apply to this programe. The third one is to have a closer look to the way I can apply the laws and principles of basic sciences (Physics, Chemistry, Mathematics and Geology) to the field of cultural heritage. My expectation was

limited related to the amount of knowledge and information that CNR gives to us while working with them; because if I did not predict to work with multidisciplinary group, which allow me to study more topics from different points of view. Actually what I expected of this programme will supply me with an enormous amount of knowledge and information which will help me develop my career in the future.

My experience as Diplomazia2 Fellow

I was enrolled in course three concerning cultural heritage. Four different institutes (ISMA, ITABC, ICVBC and IBAM) collaborated to give us this amazing course. The idea of “multidisciplinary” was very strange to me at a first glance, but after a while, I was surprised by the new knowledge and experiences that I have acquired.

The course was divided into four main sections; theoretical, practical, field trips and field work.

At the beginning of the course we started to have theoretical lectures about different topics including history of ancient civilizations (particularly in the Mediterranean basin), basics of some physical, geophysical, and chemical experiments, urban Archaeology, geology, architecture, GIS, photogrammetry and 3D reconstruction. However the above mentioned topics seem to be distinct from each other, but the professors and experts succeeded to build harmonic relationships between all of these branches of science. We spent approximately two months of theoretical lectures in Rome with some practical training on geophysics techniques (Electrical resistivity, geo-radar), also total station, GPS, photogrammetry and 3D reconstructions; where we collected some data and learned how it can be elaborated.

The theoretical lectures focused on some general topics related to Archaeology, materials decay (mortars, alloys, painting, and stones), history of some ancient civilization, graphic reconstruction, virtual heritage, conservations, valorization, architecture, chemistry, physics, geophysics and geology. We visited the historic center of Rome several times to make correlation between theoretical and actual situation. The day we spent in Spanish school of Archaeology was amazing where we experienced a very good archaeological project.

The second and third stages started directly without losing any moment. We started with both lab activities and field visits at the same time. During the second phase of the program our group moved from one place to another according to a well-organized schedule. On Monday 17th of April we moved to Florence where we started practical lessons and lab activities. We worked on

some analytical surface techniques like XRF, SEM, XRD, petrographic, spectrophotometer and colorimetric investigation in addition to some biodegradation investigating techniques. Other characterization techniques including, Salt characterization, water absorption, water vapor penetration, ancient organic and inorganic mortar inspection. The wall paintings and frescos characterization was an important part of our training where we did some measurements using portable spectrophotometer and portable XRF on some frescos inside churches. Also we visited the historical center of Florence, focusing on aspects of Monumental Conservation. The institute of restoration (Opificio delle Pietre Dure) in the center of Florence was one of the most amazing field visits in my opinion where we had a wonderful experience about restoration work.

The second stop on 28th of April, was Milano where we spent two days of field visits to the city center; Even though so short, it was useful and enjoyable. The lessons there, were about the materials decay and conservations. Our practical lesson at the Monumental Cemetery was very special where we spent about four hours amidst the tombs. The other part of the lessons was in the center of Florence; where we investigated the real situation of stones decay.

Catania was the third stop where we spent 15 days from May 1st to 14th. The experiences in Catania were characterized by more field visits and practical training than theoretical lectures. The visits included archeological museum of Catania, Acillian Baths, Museo Diocesano, Cathedral, Roman theater of Catania, archeological area of Ortygia and Neapolis, Roman amphitheater, Benedictine monastery of Catania and Roman domus, Archeological museum of Syracuse, Acicatello castle and the underwater museum. The lab activity during our stay in Catania was focusing on Archaeometry, remote sensing and 3D survey. In addition to these activities, the experts reviewed the open city project and the digital library project.

The fourth and last stop was in Sardinia Island specifically in Cagliari which overlooks the southern coast of the island. During this visit we performed the field work which is the last phase of the program. Excavation work was very tiresome and hard but also very funny and interesting. We stayed approximately two weeks from 17th up to 31st of May. The work at the Pani Loriga santadi site was very organized. Our working day started at 7am with breakfast, reaching the working site at 8 am. This was the first time in my life that I faced an archaeological experience. We started to take some lessons about the importance of this site and the ancient civilization that lived there before. The actual excavation work started the second day as of our arrival, so we faced the experience of digging. My tasks within the archaeological excavation were digging and getting the objects out, but after this amazing

experience my mind had changed completely. I realized that the excavation process is more complicated and more academic than normal digging. I was surprised by the huge amount of knowledge that can be extracted from the excavation work. I will not go in more details, rather I will summarize my experience as follows:

- Recording the findings into the site with photos, detailed notes and drawings is an essential step
- Cleaning and preserving findings in a laboratory
- Using laboratory analysis (XRD, XRF, SEM ...etc) to identify the findings and getting more information.
- GIS and total station applications in survey is very important
- Photogrametry and 3D reconstruction is an important tools for documentation.

After this wonderful working trip we went back to Rome to resume the lectures, field visits and other lab activities.

My experience as a Diplomazia2 fellow was so amazing for I could confront with new cultures and new technologies. The Italian researchers and professors try as much as they can, to remove the borders between different cultures and I think they were successful. They worked on overcoming the difficulties which could hinder our progress in this program. Sometimes I feel that I looked like a child when I tried to face some problems; because they listen carefully to us and work on solving problems directly. I liked very much their concept of handling and treating problems because they always take into consideration the social dimension. This course adds a new value to my life and deepens the meaning of teamwork. Before, I didn't know the meaning of all this as I worked with colleagues having my same expertise. The new value for me is to work as a team member in a group of different disciplines. As a physicist my interest was about pure science without regarding to the power of knowledge. I start to realize that if people don't study their past cannot control their future. My contacts with CNR experts and scientists deepened this meaning.

Generally speaking, Italy is a wonderful place. Italy for me is a special place because it contains a strange and amazing mixture of different cultures. There are so many things that I loved in Italy; The picturesque cities, the language, the culture, the people, and of course the food. Italian food everywhere is amazing and there was never a time that I was disappointed when eating out. Except for some anomalies, Italian people are co-operative, friendly and polite; they try to do their best for helping strangers. Normal life cannot go in the same straight line; however not all my days were so beautiful but what I have learned

is that, bad people give me experience, and good people print a good memory in my mind and heart. At the end of this experience, I can only state that I will never be the same person as I was before. Living in Italy made me appreciate new ideals of culture, ways of seeing the world and overcoming prejudice. Of course there were ideals of the Italian culture that I absolutely fell in love with, but there were some that just increased my love for my own country even more.

How diplomazia2 can improve my future perspectives

From the first moment in this course I decided to work on some goals that I must achieve in the future. My focus was about acquiring a better understanding of the other Mediterranean basin cultures especially Italian; together with learning and getting new experience in terms of social and professional life. In the same context, my primary goal was to learn and transfer knowledge to my home country. I started to focus on some special issues that will be promising for me in the future and at the same time I do not forget to add new knowledge from other disciplines. Actually this experience was great in terms of facing a new culture and new topics. In the past my vision was to improve my work and skip the limit of traditional work to more exciting experiences but I can't find my right way. Before applying for this fellowship my interest was focused on how I can increase my academic position. Now my future vision has changed completely and I start to re-arrange my duties.



Figura 5.7: Pictures during Diplomazia2 Activities

ALEKSANDRA LALATOVIC

Montenegro



BIOSKETCH

Architect working at Ministry of Culture of Montenegro - Department for the Protection of Cultural Heritage. Master's degree obtained at Bauhaus Dessau's COOP Design Research Master Program. Graduated from the University of Montenegro, Faculty of Architecture in Podgorica (with half-a-year exchange program in Ljubljana, Slovenia).

Engaged in issues related to ecology, social change and radical pedagogies. Interested in new technologies and sustainable design of clothing.

Why I have applied for Diplomazia2 and expectations

I was informed pretty accidentally about this opportunity that Italian government was offering to Montenegro. I checked quickly the call and applied promptly. Even though my engagement in cultural heritage was fresh and short, I decided to apply just for that reason - to get the right knowledge from the experts in cultural heritage. In addition, it sounded pretty amazing to have a chance to live in Italy for six months and study and learn by traveling, so I didn't have any doubt that the program would be a perfect choice for anyone related to cultural heritage.

I expected to learn a lot, to meet many colleagues and make friendships, to see as much as possible, to experience diverse parts and dimensions of Italy, to improve Italian language, to gain contacts and hopefully to bring that energy back home. And it all is coming true.

My experience as Diplomazia2 Fellow

Our arrival in Italy was warmly welcomed by our hosts from CNR. The first day we met our tutors and coordinators, and other researches from collaborating institutes. I also got to know other fellows including my compatriot Bozena who I didn't know before; two colleagues from Egypt, Mohamed and Mina, Khaled from Tunisia, while colleagues from Albania, Joli and Inis, I met later, as they were assigned to IBAM in Catania. During these first days, we were left some time to accommodate, get familiar with each other and deal with bureaucratic issues related to our stay in Italy.

I felt excited that something new was unfolding. It seemed like diverse sides of the Mediterranean gathered around with the same intention: to work on

enhancing our strength in protecting the cultural heritage of the Mediterranean. There was so much to find out, comprehend, learn, achieve, discuss, and elaborate in a period ahead of us.

The methodology of the course was to introduce us first to the processes that led to creating a Mediterranean as we see it today, a set of circumstances and developments mainly initiated by ancient civilizations of the Near East. These processes were mainly examined through archaeological evidences dating from prehistory and later, giving material and historical information of the ancient cultures, languages, writings, political fluxes, trade, migrations, conquests, and destructions. Initial lectures were therefore focused on the topics of cuneiform writings, archaeology and history of Bronze age at Middle East and Greek territory, moving on to Sicily and Sardinia with Phoenicians and Punics, up to the central and northern inland parts where Etruscans and Romans reigned. Many evidences of these diverse cultures, such as pottery, jewelry, household items were examined and certain links were sought to be traced (based on pottery trade and goods exchange) in order to better understand the relationship between these very diverse but yet similar cultures, trying to track their movements and comprehend their political attitudes. Another evidence of their interconnection and mutual dependence was traced through architecture, structural details, language influence and burial traditions.

Being aware that contemporary treatment of cultural heritage includes application of new technologies, we were introduced to the geophysical methods and techniques and geomatic modules - GPS/GNSS systems, parallel to the historical insight mentioned above. These theoretical introductions and practical exercises helped to better understand contemporary approach to cultural heritage, which significantly improves conservationist practice and gives important preliminary analysis (for example, in archaeology, by obtaining results from geophysical measurements on the ground, it is possible to understand invisible structures and improve planning and methodology of work). These techniques serve to unveil what is unknown and facilitate further practice, but another technology is used when it comes to representation and valorization. Here we learned about using total station to position and georefer the excavated layers, and then about photogrammetry techniques which serve to digitally visualize uncovered structures, but also help to better understand relationships between successive steps. Although utilizing these technologies can make a professional work more accurate, the last part of the chain is to be examined: how to present undertaken work to the public, and how to improve understanding of the cultural heritage. Here a contemporary conservation practice has stepped further from the classical approach, by applying digital conservation. Through the use of laser scanner and modeling

software, missing elements could be reconstructed without physically intervening on the monument. This approach proved to be very efficient for assembling a puzzle that mostly deals with the past, and if you get it through the play (by using interactive games), it makes learning even more exciting.

In this field, we had a chance to visit several museums where virtual installation was installed. By interacting with the screen, we learned how it was developed and what are the outcomes of modernizing a classical exposition.

Putting all that on one side, a mere theoretical and distant insight would not give such a tactile picture of ever-changing Mediterranean if not given a chance to see, touch and feel *in situ* how this world has changed, transformed and developed. Lectures projected on the screen lack deeper understanding and embodiment of the narrative and material history. Given this fact, we had a wonderful chance to experience these processes by traveling around.

From Rome, we moved to Florence. There the ICVBC Institute lectures focused on the aspects of monumental conservation, mainly through utilizing physical and chemical techniques: assessment of consolidation of surface and substrate by peeling test system, ultra close range photogrammetry and DRMS; bio-deterioration and techniques for their characterization; XRF analysis - theory and application; spectroscopy in UV-VIS-IR ranges by portable devices; ancient and modern organic binders in the painted surfaces, etc.

After these lab demonstrations, we continued to Milan, where we had two days of walk through the city, passing by the monuments (built structures) on which we examined decay of materials and assess their conservation.

From Milan we moved to Catania, where we continued to examine new technologies (photogrammetry and 3D visualizations), as well as digitalization of books and other similar materials. But it didn't end with Catania. We visited Syracuse and Ortygia, their amphitheatres and Regional museum of archaeology.

Sicily, informally, was taken seriously in terms of a place to be further discovered and enjoyed, so we made our best to fulfill our leisure time. We went to Palermo, looking forward to see a great example of how different cultures and religions can intertwine and merge. And we left amazed. Another city from a 'bucket list' was Taormina, a small town on the hill with its theater overlooking the amazing sea line and green hills.

What I wasn't hoping for after all the experience around Italy, is that I would be so emotionally attached to our next destination - Sardinia. It was a laborious time spent on the excavation site called Pani Loriga, where we participated in the excavation works. It was a true learning-by-doing. A group of Italian

students of archaeology joined us in work coordinated by Prof. Massimo Botto and his assistants. Getting up early in the morning, digging meticulously under the sun and then 'cleaning the dust from the ground' (as we used to joke whenever we reached a new layer of stratification) wasn't even taken as exhausting as we had a great time together. We had lectures related to our work directly on site, we learned to use new technologies as we used them directly and for a real need, we passed all the procedures of uncovering, discovering, and documenting - all by being directly engaged. In this way we embodied everything we learned. It was memorized in every blister on our hands, dust in our noses, shade under the tree where we washed excavated ceramics... Recipes that we learned by cooking for each other.

I absorbed azure color of the sea, joyful waves, sandy beaches, Italian music on the way, local food, many jokes, great people we were working with and that magical nocturnal flight of flamingos over Cagliari, a night before our departure back to Rome.

Back to Rome - this time getting to know better its museums and foreign institutions that work together on the cultural heritage. One month remains - still a lot to do and to see before awakening from a dream we have been in for all this time in Italy.

How diplomazia2 can improve my future perspectives

Since I have been involved in cultural heritage protection for a relatively short period, Diplomazia2 experience was of a tremendous importance for me. Learning from the most experienced, largely improved my understanding of the field, I believe in a right period of time.

What we realized better in this course is that a comprehensive work asks for a multidisciplinary approach. Diplomazia2 is a good example of how diverse institutions of CNR managed to collaborate and express their expertise while being sensitive for other professions. And not only by putting together diverse approaches to the problems, but by being open to exchange and understanding others' work in a way that such interaction would create an immersive and much more profound result. This is a practice I would like to improve at my institute.

Cultural heritage of the Mediterranean is a large net of many historical interactions and layers intertwined. Many civilizations influenced each other, merged and conflicted creating cities and landscapes that we have today, ancient realities that coexist and sometimes overlap with the ultramodern. Having Roman world in Lebanon, prehistory in Sardinia, Greek cities in Sicily, the Arab presence in Spain, the Turkish Islam in ex-Yugoslavia, as Fernand

Braudel would say, means that we have to observe and feel the Mediterranean cultural heritage as one organism, as a set of elements and historical layers which influence each other inextricably. Having this in mind, we (especially countries of the Mediterranean) should work together, exchanging knowledge, capabilities, and expertise, creating a network which would put an effort in managing, protecting, and evaluating common heritage, as well as improving our relationships. In this sense, I look forward to a future collaboration of my institute with CNR institutions, hoping that the practice of working together would be maintained. We are already starting to think of possible projects, which we hope will be launched in the upcoming period.

Given all the experience I gained with Diplomazia2 course, I will strive to improve working conditions and professional engagement at my home institute. At the same time, I will keep on maintaining established networks and contacts in order to give continuity to a mission that Italy initiated. I'm quite convinced that this professional training opens up many future possibilities for my job improvement and collaboration on other related projects. I'm very grateful for having had such a comprehensive experience and look forward to future cooperation.

KHALED DHIFI

Tunisia



BIOSKETCH

I am Khaled Dhifi, I am an heritage curator at the National Institute of Heritage, Tunis.

I've been working at Carthage archeological site since 2012. It is the most important archaeological site of Tunisia, added to the UNESCO list of World Heritage since 1979.

I am charged essentially of preventative and secure excavations within the Carthage area, diagnosing monuments, intervention planning and work supervising.

I had a SIG qualifying training within the framework of Tunisia National Archaeological Map in 2007.

During 2007-20012 I was a team member of Tunisia National Map of Archaeological Sites and Historical Monuments.

I am preparing for obtaining a PhD at Faculty of Arts and Humanities La Manouba in archaeology and cultural heritage. I study soil occupation during prehistoric and antique periods in the watershed of Regueb (my native region).

I am interested in the methods of archaeological survey and new technology such as GIS, remote sensing, etc.

My hobbies are sports, travelling and cinema.

Why I have applied for Diplomazia2 and expectations

I have decided to apply for Diplomazia2 program because I was sure it would strongly enrich my future researches and help me in my upcoming career. Moreover, I consider this program as a great opportunity to get in touch with the Italian culture and its heritage.

My friends and colleagues who participated in Diplomazia1, encouraged me to participate in this beautiful experience and they confirmed the importance of this training program.

I liked very much the idea of spending six months at CNR. This would give me a chance to deepen my culture, heritage knowledge in the inspiring, creative, and cosmopolite environment of one of the largest research institutions.

My experience as Diplomazia2 Fellow

During the six months of my participation in course3 of Diplomazia2, I had the opportunity to enrich my knowledge of heritage science and technology. The program focused on governance of knowledge, management, preservation, enhancement and sustainable use of cultural heritage.

This professional training was provided by four Institutes working in the field of cultural heritage belonging to the Italian National Research Council: ICVBC, ITABC, ISMA, IBAM.

The course included didactic lectures and class discussions, case studies, practical exercises, on site visits, group work that takes place around the three essential components of heritage (city and landscape, monument and objects) The lessons began on February 13th 2017 with seminars and didactic lessons until April 13th.

During these two months we had about 150 hours organized by institute and theme.

The topic submitted by **ICVBC**:

- Materials and decay phenomena: identification of artefacts, origin, working techniques.
- Definition of decay phenomena, study of decay mechanisms.
- Diagnostic techniques.
- Method and techniques of conservation: bio-deterioration control, cleaning, consolidation and protection.
- Preventive and planned maintenance
- History of Architecture and of the Mediterranean city.
- History of medieval and modern Art and Architecture.
- Conservation and Valorisation of historical centres.

The topic submitted by **ITABC**:

- Geophysical methods and techniques used in archaeological survey:
- Reality-based acquisition methods and techniques: photogrammetry and photo scanning system.
- Virtual Reality methods and techniques: photogrammetry, 3D reconstruction, Graphics and computer animation, Virtual Museums, digital mapping and GIS.

The topic submitted by **ISMA**:

- The history and archaeology of the different civilization on the Mediterranean area: (the Mediterranean and European proto-history, the ancient Near East, Phoenician and Punic civilization, Etruscan civilization and Italic archaeology)
- Computer applications and Mediterranean archaeology.
- Knowledge of library science and bibliography.
- Databases and automating catalogue of cultural heritage.

The topic submitted by **IBAM**:

- Archaeology and History of the Mediterranean countries.
- Methodology of archaeological research: description of the main methods and tools of current archaeological research.
- Geographic information systems and data management: leading and innovative information systems and spatial data management.
- Elements of digitization and image processing: knowledge of principal and innovative systems for scanning and image processing.

Between April 17th and April 27th: visits, see and practice of the different techniques of study, diagnosis and conservation of artefacts used by ICVBC laboratories in Florence and Pisa:

- Bio-deterioration technique and their characterization.
- Imaging technique.
- Assessment of the consolidating of surface and substrate by peeling test systems, ultra- close range photogrammetry and DRMS.
- XRF analysis.
- Spectrophotometer and colorimetric investigation.
- Spectroscopy in UV-VIS-IR range.
- Petrography and mineralogy analysis.
- Visit of the historical centre of Florence and Pisa focusing on aspects of monumental conservation.

On April 28th and 29th: we visited monuments in Milan, focusing on materials decay and conservation.

Between April 30th and May 14th: visit of the laboratories and the archaeological sites and the historic monuments in Catania and Syracuse:

- “Ursino-Recupero” Library.
- Laboratory of Topography, Remote Sensing and 3D Survey.

- Visit in Catania: Roman Amphitheatre, Greek-Roman Theatre, Cathedral, Church of San Nicolò Arena, Benedictine Monastery, Roman Domus, Museo Diocesano, “Achillian” Baths Acicastello and the Underwater Museum.
- Visit in Syracuse: Archaeological area of Neapolis, Archaeological Museum of Syracuse and San Giovanni Catacomb.
- Ortygia: Castello Maniace, Apollonion, Athenaion/Cathedral.

Between May 15th and May 31th: excavation mission in Pani Loriga archaeological site: got an idea about excavation techniques, artefact studies, documentation and use of new technologies.

We also had the opportunity to visit Sant’ Antioco (archaeological sites of *Nuraghe Grutti e Acqua* and the Giant’s Tombs).

For the last two months: the continuation of some theoretical lessons, visits to the museums and archaeological sites to see some realised project:

- Visit of two small historic cities: Zagarolo and Genazzano.
- Visit of “Villa romana” of Cottanello focusing on material characterization, decay, diagnostic methods and restoration interventions.
- Visit of Martouranum Regional Park.
- Visit of BSR British School at Rome.
- Visit of British School at Rome.
- Visit of French archaeological institution in Rome.
- Visit to Musei Vaticani.
- Visit to Tuscolo archaeological Park.
- Visit to museo nazionale di arte orientale.
- Visit of ICCROM, International Centre for the Study of the Preservation and Restoration of Cultural Property.

It is my first stage outside my country Tunisia; I appreciated very much this formidable experience. It allows me to expand my awareness, knowledge, skills and understanding of current techniques and methods in cultural heritage management.

The most important thing for me in this experience is to maintain good relationships and a large network for future collaborations and to be aware of novelty in our field and to share my experiences and results.



Figura 5.8: some activities during Diplomazia2 Training Course

Italy is a very charming country in the Mediterranean world with its own culture, art, tradition, historic cities and archaeological treasures. It is the cradle of the Roman Empire and Renaissance and homeland of many ancient civilisations. Each region of Italy has a stratification of several civilizations; this was very well managed and enhanced. I enjoyed very much the walking trips in the many beautiful Italian cities. I visited Florence, Pisa, Milano, Catania, Syracuse and south of Sardinia.

How diplomazia2 can improve my future perspectives

During diplomazia2 program I met several people having different profiles who all work in the field of preservation of cultural heritage. I also saw several experiments and Italian projects. I benefited greatly from this program in knowledge and expertise. All these positive factors will influence my next projects and researches thus helping me improve my abilities.

5.3 Tutors and Lecturers

SAMUELE BARONE

CNR – IBAM, Tutor and Lecturer



BIOSKETCH

Research Technician at IBAM CNR, expert in digitization of 2D and 3D cultural heritage. It deals with the creation and maintenance of technical infrastructures in research projects that include the digitization of library, archaeological and monumental heritage as well as the use of research data across the web. He has collaborated in several international and national projects as a digitized operator through the use of professional instrumentation such as planetary scanners, laser scanners and drones for aerofotogrammetry.

Abstract

During the lesson (with Giovanni Fragalà) the theme of digitalisation of libraries and manuscripts was addressed from the analysis of the specimen to the choice of the digital acquisition instrumentation. Starting from the guidelines promoted by the European community on this theme from 2005 to date, attention has been focused on the most innovative, interesting and state-of-the-art projects that can showcase the main European best practices and policies currently in use by the international community. In particular, it was considered appropriate to demonstrate, through a practical and direct exploration, the development of the large Europeana portal (<http://www.europeana.eu/portal/en>), currently available in 23 languages and containing data of different genres and format (Books, music, audio, newspapers, maps, etc.). Subsequently, the Central Institute for the Single Catalog (ICCU) and the National Research Council (CNR) presented the Science & Technology Digital Library project, born under a protocol between the MIUR and CNR.

The second part of the lesson, in fact, was entirely devoted to the activities carried out by the IBAM under the aforesaid project. From the preliminary reconnaissance, analysis and census of the documentary heritage chosen for the digitization process, namely the rich and complex library and manuscript heritage of the Benedictine Library of the Monastery of S. Nicolò Arena of Catania currently held at the Libraries of "Civic and A. Ursino" in Catania, has

gone to the description of the instrumentation acquired by the Institute for digitization operations.

During the visit to the IBAM digitization laboratory, the operation of planetary scanners and the various features, modulated on the basis of the technical needs and the different types of support, have been demonstrated. Specifically, the operation of the Planetary Scanner with a Tri-Line CCD sensor and automatic focusing with a tilting top and a motorized glass plate, has been designed to achieve a very high definition of the master files of the captured images and to have an optical resolution of 600 x 600 dpi real to A1 format and allows you to digitize volumes, as well as cartography and illustrations, even in large sizes, reaching a very high definition. It has also been described the operation of the Planetary Scanner with a fixed head CCD sensor that is more versatile in scanning digital manuscripts and volumes with a standard of quality based on a true optical resolution of 400X400 dpi up to A2 format. Finally, the lesson ended with a practical activity on inserting metadata, that is, data describing the characteristics and properties of a digital product by compiling the 15 Dublin Core standard's tags through the use of open source software And creating XML tagging files.

GIACOMO BIONDI

CNR – IBAM, Lecturer



BIOSKETCH

Archaeologist, Researcher at IBAM-CNR in Catania. He deals with Archaeology of landscapes and Archaeology and history of classical art, with particular reference to Crete and Sicily during the Iron Age.

Abstract

The activity focused on two case studies, Centuripe (Sicily) and Prinias (Crete), which set the starting points for introducing and illustrating the research methodologies on the Archaeology of hilly and mountain landscapes in the Mediterranean, from the collection of information on the territory (archive data, bibliography, literary and oral sources, toponyms, remote sensing, archaeological surveys, etc.) to their elaboration and interpretation in a diachronic view of interaction.

GIUSEPPE CACCIAGUERRA

CNR – IBAM, Tutor and Lecturer



BIOSKETCH

Archaeologist, Researcher at Institute for Archaeological and Monumental Heritage - CNR. He coordinated the Italian-Belgian Joint Laboratory Project «ROMA» (*Roman baths archaeological, conservation and heritage Management*) and coordinates the IBAM-CNR archaeological research in Valle dell'Acì and Catania within the “NEPTIS” Project (*ICT based solutions for augmented fruition and exploration of Cultural Heritage*). He worked on the project «Roman Sicily Project: Ceramics and Trade» in order to create a database of Roman ceramics and participated in the Research Unit for the project “Problemi archeologici e archeometrici nelle importazioni di ceramiche africane nella Sicilia romana, vandala e bizantina. Status quaestionis, metodologie e percorsi di indagine”, within the framework of scientific cooperation between the IBAM-CNR and the CCJ-CNRS. He has participated in numerous excavations and researches in the Mediterranean Countries (Italy, Cyprus, Turkey, Albania).

Abstract

The lessons have dealt with the theme of material culture through research on Hellenistic, Roman and medieval pottery in order to define the role as source for socio-economic interpretation of Mediterranean communities. The lessons have dealt with two important periods and case studies about the productive, technical and technological transformations between the Hellenistic and Late Antiquity. The first context illustrated was Syracuse, recently subject to multidisciplinary investigations by the IBAM. This urban context has shown interesting documentation on the passage between the Hellenistic and the early imperial ceramic productions. In particular, the technical and technological changes of the production were illustrated with the transition from black to red slip and the problem of archaeological indicators of Republican production, such as pottery kiln, wasters and spacers. The second context analyzed during the lesson is that of Sagalassos in Turkey. About this context, it was shown an Italian-Belgian research programme on imperial and Byzantine Red Slip Ware and moulded productions with figurative, vegetable, zoomorphic impressed decoration on *oinophoroi* and bowls.

ANTONIO CAVALLARO

CNR – IBAM, Tutor and Lecturer

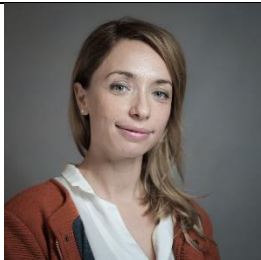


BIOSKETCH

Civil Engineer, Senior Research Scientist of IBAM-CNR. He is currently studying a seismic microzonation of Catania's historic center, based on the geotechnical and structural characterization of some historical Churches and buildings, based on the definition of a scenario earthquake in order to evaluate possible attenuation or amplification phenomena and to assess the restoration and structural improvement of the buildings.

Abstract

The course (in collaboration with Giuseppe Cacciaguerra, Giovanni Fragalà and Samuele Barone) aimed at providing the basis for knowledge of the methodologies and research technologies of European and Mediterranean urban Archaeology from the English and French experiences, such as those dealt with by Carver, and the Italian ones developed in numerous cities of 'Central-northern Italy. In particular, the case of Catania on which IBAM-CNR has been working for years with targeted research projects has been illustrated. In particular, the problems related to anthropic, hydro-geological and seismic-volcanic hazards have been addressed. Just seismicity has provided the scholars with important information on the effects of Etna earthquakes and eruptions that have affected the city in the past and how they have altered the development in the vertical and spatial direction. In addition, cases of long-lived urban complexes such as Siracusa have been dealt with, which have different development features than Catania, despite its geographical proximity, and that of Sagalassos, which is nevertheless a non-long-term context. Finally, the main non-invasive tools and methods of research, such as geophysics, have been dealt with and illustrated to scholars, widely used in the evaluation of the archaeological potential.



BIOSKETCH

Licia Cutroni, Technologist at IBAM CNR, where she has also been research fellow developing her main research activities within the project on Smart Cities and Communities led by Engineering SpA and named “Tourism and Culture: DiCet-Inmoto”, whose main aim was to define and implement models, processes and tools for sustainable development of an intelligent territory through the exploitation of its cultural heritage and environmental resources. She acquired a wide experience in Project Cycle Management working for the implementation of research projects on cultural heritage.

She participated in several European projects being involved in the activities dealing with the transfer of technology and innovation being also regional contact point of the APRE- Agency for the promotion of European research. In 2013, within the process of Smart Specialisation Strategy she has worked to foster the collaboration between research centres, SMEs and regional institutions, supporting the creation of guidelines in the field of Smart cities and Communities and Cultural Heritage..

Abstract

The lessons (in collaboration with Giuseppe Cacciaguerra and Giovanni Fragalà)) have dealt with the topic of data management for the planning and sustainable development of urban areas and territories with a high density of archaeological and monumental heritage. The main models of database and GIS and Web-GIS platforms have been illustrated through the experiences of the MAPPA project on Pisa and SITAR on Rome. The lessons, in particular, have dealt with the OPENCiTy Project, a multidisciplinary research project initiated by the IBAM-CNR on the city of Catania. The goal is to create a tool that can be enhanced through the free sharing of data from the historical-topographic research conducted in the urban area, collective knowledge, promoting planning and territorial protection. During the lesson, the process of creating databases, the GIS platform and Web-GIS has been described.

These elements that are given the role of storing and making freely accessible geospatial data the data for the complex urban stratification of Catania.

FABIO CARUSO

CNR – IBAM, Lecturer



BIOSKETCH

PhD in Archaeology and History of Greek and Roman Art, Researcher at IBAM-CNR in Catania. His research is mainly focused on iconography and iconology of greek archaic and classical age, and has gained particular experience in the field of Greek figured pottery.

Abstract

The lesson has dealt with a general overview of problems related to Greek ceramic production, with focus on the Athenian vases, prevalent on all the others, for the quantity that have come to us, the diffusion in the Mediterranean and the significant presence of this class of materials in the major European and extra-European archaeological museums. The following points were dealt with in detail: 1) the importance of ceramics in archaeological, historical, artistic and historical research; 2) periodization and dating criteria based on the evolution of pottery technique and style; 3) production techniques: clay, from quarry to pottery workshop; the steps of modeling the vessel; the decorative techniques (black figures, red figures, white backgrounds); The baking process; 4) the character and significance of the inscriptions, painted and graffiti; 5) the main vascular forms and their function (vases to hold, vases to mix, pots for drinking, ritual vessels); 6) Trade and distribution of vessels along the Mediterranean routes.

MASSIMO CULTRARO

CNR – IBAM, Lecturer



BIOSKETCH

First Researcher at CNR-IBAM, specialized in Mediterranean prehistory and Cultural Heritage Communication Systems. Author of scientific essays on the Aegean of the Bronze Age, is a professor of Palaethnology and Archaeology at the University of Palermo.

Abstract

The seminar lecture dealt with new approaches and methodologies applied in the field of Palaethnology through some case studies borrowed from different contexts of the Mediterranean pre-protostory. The general principles of human and natural time measurement have been addressed and as these combine and above all how they can be fixed absolutely through dating in the laboratory analysis.

In addition, the choice of the well-known case of the Similaun mummy (Innsbruck Museum), dated to the Copper Age, allowed to deal transdisciplinarily with the main questions about the most modern biomolecular Archaeology research as a field of Challenge of the new millennium Palaethnology. The issues addressed, which also involved wider reflections on the use of ethno-anthropological sources (eg in the case of the meaning of tattoos and their symbology), involved the fellows in discussions to reflect on the systems of reconstruction of the past of man in the absence of written sources.

GIOVANNI FRAGALA

CNR – IBAM, Lecturer



BIOSKETCH

Head of the Laboratory of Photography Applied to Archaeology at the Institute for Archaeological and Monumental Heritage of the National Research Council (IBAM-CNR). He has been involved in archaeological photography for several years in archaeological missions in Italy and abroad. He has

	participated at training workshops and didactic workshops on archaeological photography and has photographic documentation for the scientific edition of archaeological research on national and foreign publications.
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Abstract

The lecture (in collaboration with Samuele Barone) aimed at introducing fellows to archaeological, landscape and environmental survey and monitoring with UAV platforms (drones) in order to set activities for conservation, safeguarding and fruition of the the archaeological and monumental historical contexts. The course has led its participants to discover new methods of data acquisition through drones (3D survey, Lidar, thermal chambers, etc.) by providing innovative insights into the definition of the profession of archeologist as well as the operator in the differentiated sector of the cultural heritage, focusing attention on the cultural and natural values . In addition, during the lessons, particular attention has been paid on the management of the workflow, from the structure of the work platform, to the preparation of the flight, to the acquisition and processing of the data as well as to the final analysis and evaluation of the data acquired. During the lessons, a drone model has been shown, which has allowed to provide all the knowledge on the instrument and its various technical and technological components and support in archaeological research and cultural heritage in general.

GAETANA MARCHESINI

CNR – IBAM, Tutor and Lecturer



BIOSKETCH

Underwater Archaeologist, is a Technical Research at IBAM-CNR. She collaborates in research programme with the Superintendence of the Sea (Sicily) and has conducted numerous underwater excavations and survey at central Mediterranean archaeological sites.

Abstract

The lessons have dealt with the theme of underwater archeology through the presentation of the main research methodologies and survey techniques, the history of the discipline and of the most important researchers who conducted underwater archeological studies and excavations. In addition, the students participated to laboratory activities at the Acicastello Museum, that has an underwater archeological section with archaeological finds (amphorae, anchors, etc.) founded in the Catanian coast. The scholars had the opportunity to examine some types of amphorae dating to different epochs, coming from an underwater archaeological site near Ognina (Catania).

ANTONELLA PAUTASSO

CNR – IBAM, Lecturer



BIOSKETCH

Researcher of IBAM-CNR, is Deputy Director of the Italian Archaeological Mission in Priniàs (Crete) and Scientific director of some international (CNR-CNRS 2010-2013, INSTAP grant 2012-2014) and national projects (CNR Research Director 2010-2015, Head of Research Unit PRIN 2007). Co-founder of the international HaCoSt (Handbook on Coroplastic Studies) research group run by the University of Lille3. Member of the Doctoral School of Cultural Heritage at the University of Palermo. Author of five volumes and about eighty articles.

Abstract

The activity carried out during the project covered a frontal lesson organized in two parts: 1) Use of clay as a means of artistic expression at various times, history of research and the impact of the first discoveries on the artistic culture of the 18th-19th century. The different manufacturing techniques used in antiquity: handmade modeling, turning and mould technique and observations on the organization of pottery workshops; Contexts and meaning of coroplastic in the sacred and funerary context and "social" reading of representations. 2) Case study: analysis of a "votive system": the deposition of Piazza San Francesco in Catania. History of excavation and type of materials. Contextual reading of coroplastic's iconography and reconstruction of the "votive system" in the two phases of the sanctuary. Focus on the worship of Demetra and Kore. The Thesmophoria, meaning and organization of the festivals: from myth to rite.

DANILO PAOLO PAVONE

CNR – IBAM, Tutor and Lecturer



BIOSKETCH

Research Technician at IBAM CNR in Catania. Photographer and videomaker expert in photographic documentation of archaeological contexts, monuments and finds, he work mainly in the field of systems of valorisation and fruition of the archaeological and monumental sites of Catania, Pompei and Sagalassos (Turkey).

Abstract

During the lessons and workshops, aimed to illustrate the technologies, methodologies and image-based techniques of acquisition and realization of virtual products for the documentation and fruition of archaeological contexts and monuments. In particular, the lessons had dealt with the process of realization of photogrammetry and digital reconstruction of artifacts and environments to interactive fruition, and the process of realization of Virtual Tour or Immersive Galleries which today constitute an interesting platform for the fruition of the monumental cultural heritage on web and mobile. The main products developed on the archaeological heritage of Catania, Pompei and Sagalassos (Turkey) were shown. The scholars also had the opportunity to use the tools and software at the laboratory, and to acquire a preliminary mastery of the main methodologies and techniques for data acquisition and processing.

LIGHEA PAPPALARDO

CNR – IBAM, Lecturer



BIOSKETCH

Researcher at the IBAM-CNR in Catania, she works at the non-destructive analysis laboratory “LANDIS” of the National Laboratories of the South (LNS) at INFN in Catania, where he is engaged in scientific activity in the field of cultural heritage. The main interest has been the development and subsequent use of new techniques and methods for in situ and non-destructive analysis (PIXE, XRF and XRD).

PAOLO ROMANO

CNR – IBAM, Lecturer



BIOSKETCH

Researcher at the IBAM-CNR in Catania, she works at the non-destructive analysis laboratory “LANDIS” of the National Laboratories of the South (LNS) at INFN in Catania, where he is engaged in scientific activity in the field of cultural heritage. The main interest has been the development and subsequent use of new techniques and methods for in situ and non-destructive analysis (PIXE, XRF and XRD).

Abstract

The didactic activity (with Lighea Pappalardo) aimed to illustrate the principles of nuclear physics on which the PIXE-alpha, XRF, XRD and XRF techniques are used in the LANDIS laboratory for non-destructive chemical-mineralogical characterization of archaeological materials. The fellows were invited to the LANDIS laboratory where they used the portable PIXE-alpha spectrometry system for surface analysis. The fellows attended the analytical procedures on which these techniques were based and actively participated at the chemical analysis of a black and red painted pottery reproduction in order to identify the presence of chemical elements that characterize the black pigment.

SALVATORE RUSSO

CNR – IBAM, Tutor and Lecturer



BIOSKETCH

Research technician at IBAM-CNR, Catania, expert in topography, 3D Laser Scanner and image based survey and photogrammetric processes. He work in archaeological and monumental indoor and outdoor sites in Sicily, Calabria, Pompei and Sagalassos (Turkey).

Abstract

The lessons were aimed at presenting methodological and technical innovation for noninvasive surveys in the field of cultural goods. The lesson, in particular, was focused on modern topographic techniques useful for digitizing monumental assets with particular attention to the 3D Laser Scanner methodology. The many advantages of this technique have been highlighted with a careful analysis of instrumentation types. A wide range of case studies have been presented throughout their procedural process: three-dimensional design, point cloud capture, cleansing and alignment of the various points clouds detected, product development for Solid Mesh, photo texturization processes of Mesh and cloud points. The case studies shown during the lessons are the direct result of projects carried out by the IBAM-CNR. The laboratory activity was conducted with a direct exercise with the total station in order to learn how it is used and the benefits of such tool.

STEFANIA SANTANGELO

CNR – IBAM, Tutor and Lecturer



BIOSKETCH

Archaeologist, expert in ancient numismatics, from 1999 to 2008 she participated in Misurata coin project in Libya, one of the greatest treasures of antiquity (108,000 bronze coins from 294 to 333 AD). Recently, she have focused on an unpublished collection of Arabic-style coins preserved at the Syracuse Archaeological Museum.

Abstract

The lessons aimed to illustrate the history of monetization, its "invention" or "evolution" - from barter - to the emergence of the real currency, characterized by an imprinted image on a metal weight. Therefore, the main tools for a first classification and interpretation of the monetary object were provided. The main elements of some issues have been examined, such as the type and the legend which in ancient times provided important information about the issuing authority and political, economic and social messages. Furthermore, the iconographic language of the coins was analyzed by referring to recent studies on "grammar" that governs the iconographic structure with which the main monetary types are conceived and selected in connection with the accessory symbols. Lastly, the Laboratory at the Syracuse Archaeological

Museum has allowed to observe the masterpieces of Greek numismatics in the mediterranean world, and provided interesting discussion about the exhibition and attraction modes for a fruition.

ALESSIO TOSCANO RAFFA

CNR – IBAM, Lecturer



BIOSKETCH

Classical archaeologist, is researcher at CNR-IBAM in Catania and a lecturer of “Archaeology of Late Antiquity and Medieval Settlements” at the University of Messina. He has coordinated many excavation campaigns and surveys in Sicily (Licata / Finziade, Taormina, Roman Villa of Patti), in Turkey (Hierapolis of Frigia), and Greece (Skotoussa).

Abstract

The didactic activity aimed to illustrate the Archaeology of the sicilian hellenistic cities. The theme was dealt with on the basis of research on the settlement of the Licata area (Agrigentum) with particular reference to the hilly and coastal area of "Mountain" of Licata, located at the southern estuary of Himera river. The study of ancient sources and toponomastics, geomorphologic analysis of the territory, bibliographic and archive research, archaeological survey and the analysis of material culture have allowed to reconstruct historical, settlements, political, economic and social development of this important area of Sicily. The lessons have also dealt with numerous insights on excavation contexts, archaeological complexes of great importance, on the Hellenistic-Roman city of Finziade, the last Sicilian colony of Sicily, founded in 282 BC, and on the history of the site before and after The foundation of the city, from the prehistoric age to the late antiquity.



BIOSKETCH

Senior Researcher, Chemist
ICVBC responsible for the Mobile Laboratory for non-invasive and micro-invasive analyses of works of art.

In the framework of scientific activity a special interest is paid to glass based materials

Abstract

Glass and ceramic (in collaboration with Emma Cantisani)

Glass: the first part concerned a general overview about the materials and the techniques for the creation of glass during centuries. Special attention was devoted to the evolution of the use of materials according to provenance and historical period. A special focus was paid to the information that can be obtained by crossing stilistical, technical and archeomeric data.

Imaging techniques (in collaboration with Donata Magrini)

The first part was focused on an overview about the basic principles of imaging techniques followed by a specific presentation for each one (UV fluorescence, IR reflectography, multispectral and hyperspectral imaging, radiography, visible induced luminescence etc.). By using examples of application on real works of art the advantages and drawbacks of each techniques were outlined. The last part has been devoted to highlight the integration of these techniques into analytical protocols and how these can support and assist other types of analysis (both non-invasive and microinvasive).

Some practical examples were conducted in the ICVBC laboratories in order to gather information about specific issues on the use of the instrumentation.

Analyses of samples

This lesson started with general and ethical considerations about the possibility or not to take samples from a work of art. This latter argument is very important because the attitude of each curator/responsible for the objects may be different.

Another important aspect to focus on was about the typology of sample which is strictly related to the analytical procedure applied after sampling. Examples of analytical protocols for samples taken from easel painting and mural painting were illustrated with detailed information about the preparation of the samples (thin and cross sections) and to the analytical procedures. A special focus was dedicated to the use of different types of optical microscopies and to the scanning electronic microscope (SEM-EDS).

EMMA CANTISANI

CNR – ICVBC, Lecturer



BIOSKETCH

Researcher, Geologist

She is an expert in X ray techniques and microscopic optical and electronic techniques applied to different materials in Cultural Heritage (pigments, plasters, mortars, ceramics, glasses, stones) for archaeometric and conservative purposes.

Abstract

Glass and ceramic (in collaboration with Susanna Bracci)

Ceramic: A general overview about the raw materials and the techniques used for the creation of ceramics was proposed. Special attention has been devoted to the archaeometric studies of ceramics in order to reconstruct the manufacturing technology, to determine of the provenance of the artifacts, to assess the state of conservation. Some examples of published studies were presented.

Mortar

The lesson focused on mortars, plasters and their classification. A description of characteristics of raw materials used to prepare the mixture was proposed. The setting reaction of different type of binders (air hardening lime, magnesian lime, hydraulic lime, ecc), the role of aggregate, water and additives in the mixture were described. The different analytical methodologies used to study ancient mortars were presented with numerous case studies. A special attention was devoted to petrographic approach.

OANA ADRIANA CUZMAN

CNR – ICVBC, Lecturer



BIOSKETCH

She has a PhD in Science for Conservation with a background in Natural Sciences and Biology. She worked as a researcher and collaborated in many projects at the Institute for the Conservation and Valorization of Cultural Heritage – National Research Council (ICVBC-CNR), since 2006. Her main interests are: investigation the biological growth and biodeterioration phenomena on cultural heritage assets; efficacy evaluation of new control methods against biodeteriogens or biofilm formation on monumental heritage; development and application of non-invasive or micro-invasive techniques to identify and characterize the microbe-surface interaction, microbial diversity and conservation state of materials; natural fiber investigation; biotechnological use of microorganisms in cultural heritage and environmental fields.

Abstract

Biodeterioration and characterization techniques

The aim was to give a general overview on the biodeterioration phenomena, with a focus on the causes of biological decay and on their effect on different materials, and on the main characterization techniques. Different case studies were presented and the main issues were related with the study of biodeteriogens and of biodeterioration process, the understanding of different types of deterioration, the advantages of microscopic characterization (optical microscopy, fluorescence microscopy, scanning electron microscopy), the use of traditional, molecular and non invasive methods (pulse amplitude modulated fluorescence, bioluminescence) for investigation the biodeteriogens and their interaction with the support material.

FABIO FRATINI

CNR – ICVBC, Lecturer



BIOSKETCH

Geologist, petrographer, expert in the study of the natural and artificial stone material of architecture. He likes: mountain hiking, sailing, cycling, swimming in open water, regional languages, vernacular architecture.

Abstract

In a first step the lesson focused in the description of the stone materials commonly used in architecture, with particular reference to those of Tuscany and to their problems of conservation.

A second part of the lesson took in consideration the earthen architecture, little known but widely diffused in Europe, Maghreb, Middle East, China, therefore constituting a large part of the world Cultural heritage. The building technologies and the problems of conservation were examined.

LAURA GENOVESE

CNR – ICVBC, Tutor and Lecturer



BIOSKETCH

Researcher, PhD Archaeologist. Her research concerns urban archaeology and solutions for sustainable enhancement of cultural heritage. Regarding these issues, she has been working in international projects aiming at enhancing archaeological and historic sites in their territorial context following the UNESCO Recommendation on the Historic Urban Landscape (HUL); at evaluating methods and tools to improve a sustainable fruition and a cultural tourism.

Abstract

A general overview of the Euro-Mediterranean history of Art and Architecture, in Middle Ages and Modern Time, particularly focusing on building techniques and knowledge transmission, was the occasion to introduce some ICVBC's case study experiences, in order to give evidence of some fundamental work approaches. That is, primarily, the integration of conservation and enhancement of cultural heritage, also supported by ICT tools; secondly, the heritage enhancement in their territorial context, aiming at a sustainable territorial development. Lastly, the evaluation of methods and tools to improve a sustainable fruition and a cultural tourism. In this regard, some onsite training activities have been undertaken in the monumental center of Rome, in order to provide an overview of different approaches in enhancing cultural heritage in a UNESCO site affected by mass tourism. Surveys included the testing of the "Preserving Places" protocol for monitoring human risks and quality of life.

LOREDANA LUVIDI

CNR – ICVBC, Tutor and Lecturer



BIOSKETCH

Chemist, researcher at the Institute for the Conservation and Valorization of Cultural Heritage. Her scientific activity mainly concerns the conservation of stone materials (studies of decay, evaluation of cleaning methods, protective and consolidation treatments) and designing protocols aimed at evaluating effectiveness and harmfulness of conservation works.

Abstract

The topic of my lessons is focused on the conservation of natural and artificial stone materials, in particular on consolidation treatments and methods of evaluation of the applied products. Inorganic nanoparticles and bio-based products have also been considered as an alternative to replacing traditional treatments where toxic chemicals and hazardous methods for the health of restores and the environment were used. This is in line with the global trend toward more sustainable restoration and the development of guidelines for Green Conservation.

Practical activities in the laboratory and in archaeological sites (Cottanello Roman Villa and Tusculum in the Albani Hills) were carried out to assess the effectiveness and harmfulness of the traditional and eco-friendly treatments both on laboratory specimens and on site through measurements with portable instruments.



HELENI PORFYRIOU

CNR – ICVBC, Coordinator and Lecturer



BIOSKETCH

Urban historian. Senior Researcher. Head of the Rome Unit of ICVBC. Research interests on urban design, conservation and enhancement.

Abstract

Urban history, conservation and the UNESCO Historic Urban Landscape approach.

Two were the major subjects treated in the lectures. “Urban History of Euro-Mediterranean countries” gave a general introduction of the fundamental disciplinary principles and of the spatial evolution of the European city. “Urban archaeology: conservation and valorization best practices in Europe”, proposed an analysis of the concept of urban archaeology and offered a brief presentation of the urban conservation movement since mid-20th century up to contemporary issues and best practices, introducing the 2011 UNESCO recommendation of the Historic Urban Landscape - HUL.

Furthermore, a couple of full day field visits were organized, allowing the students to better comprehend the theoretical concepts introduced in the lectures. Thus, the visit to the historic center of Rome, focusing on the historic stratification of the city, illustrated in situ questions relative to urban Archaeology and the Italian approach to urban conservation and enhancement, through the case study of the biggest UNESCO World Heritage site. More specifically, the visit helped the students to personally verify how antique Roman buildings have been utilized in medieval and renaissance times and how conservation and transformation are intermingled concepts in urban development.

Finally, the field trip to the small historic towns - *borghi* of Zagarolo and Genazzano, in the vicinity of Rome, aimed to illustrate the urban development of a characteristically European traditional urban typology (that is of the small town; *borgo*) highlighting issues, treated in the lessons, relative to urban conservation and the UNESCO HUL approach.

FERNANDA PRESTILEO

CNR – ICVBC, Tutor and Lecturer



BIOSKETCH

Conservation Scientist, PhD in Environmental Sciences, she is research technician at the Institute for the Conservation and Valorization of Cultural Heritage - National Research Council of Italy. Her research, studies and teaching focus on issues related to indoor deterioration processes of artworks, especially stone and paintings. Her research activity mainly aims at investigating methodologies and techniques for diagnostics and microclimatic monitoring of Cultural Heritage.

Abstract

The lessons focused on mural paintings, with particular attention to the execution techniques and related used materials across different historical periods (from Ancient Egypt to Contemporary Art) and geographical areas in the Mediterranean Basin. After this overview, attention was paid to the classification of the causes of deterioration (physical, chemical, biological) of mural paintings, and subsequent effects of decay through the presentation of some case studies. In addition, the UNI Lexicon of Decay (technical regulations in force in Europe about Cultural Heritage methodologies) was illustrated. During the visit at Cottanello Roman Villa, the treated topics were illustrated on site having as case study the roman painted plasters.



SILVIA RESCIC

CNR – ICVBC, Lecturer



BIOSKETCH

Geologist, study of stone materials and their decay mechanism, set up of instruments for surface mechanical properties assessment of stone materials and performance evaluation of conservation treatments.

Abstract

Techniques for determining the superficial “mechanical” properties of the stone materials.

In the lesson the importance of the assessment of the mechanical superficial characteristics of stone material and the development of specific techniques for Cultural Heritage, was stressed. In fact the first evidence of decay of a stone material is the decrease of the superficial mechanical properties namely the cohesion; moreover classic methods to determine mechanical properties are not suitable and too destructive for the application in the field of Cultural Heritage. So the necessity to develop specific instrument and method to the assessment of mechanical properties in the field of Cultural Heritage for on lab and on site tests. The instrumentation designed and/or adapted in ICVBC laboratories and dedicated to studying the superficial “mechanical” properties of stone material were presented. After theoretical explanation, in lab some of the previous technics to evaluate state of conservation but also performance of consolidations treatment, were showed.



BIOSKETCH
Researcher, Chemist.

Abstract

Diagnostic – Evaluation of treatments.

A first hour of lesson was focused to introduce the students to some of the most important tests we are used to execute on stone materials in order to check the relative state of decay and to evaluate the performance of some conservative interventions. After a brief summary about a conservative intervention in order to highlight some important points, several tests were described, and then they were showed in laboratory during 4 hours of practical activity.

Salts induced decay.

Soluble salts play an important role in the deterioration of stone, especially in the Mediterranean Basin, contaminating stone materials by several routes, such as capillary rise of groundwater, dry deposition from aerosol by the sea (sodium chloride), air pollution in urban areas (sulphates, nitrates), and so on. Salts can cause stone decay by different mechanisms. So a first hour of lesson was dedicated to let the students understand how much is important the role of the soluble salts in conservation of stone, and what can be done about it. Then some case studies were described and the most important analyses aimed at qualitative and quantitative determination of soluble salts present in artworks were showed during 4 hours of practical activity.

BARBARA SALVATORI

CNR – ICVBC, Lecturer



BIOSKETCH

Researcher, Chemist

She is an expert in FT-IR and X-ray spectroscopic techniques, optical and electronic microscopy applied to different materials in Cultural Heritage (metal, stone, pigments, plasters, mortars) for archaeometric and conservative purposes.

Her research lines include the performance and durability evaluation of conservation treatments, the study of materials used in contemporary art, evaluation of chemical and physical methods for cleaning vandal paints on stone, in-situ monitoring of artistic surfaces through non-invasive techniques.

Abstract

Metals and alloys in the ancient art, archaeology and in the contemporary art

A general overview on metals and techniques for production of alloys (especially bronze, brass and iron- carbon) was presented. Manufacturing techniques for metal statuary were discussed, showing the different steps of direct and indirect lost-wax casting, the influence of working on surface appearance and on the metal microstructure. Examples of surface defects and repairs were also shown. Decoration methods such as gilding (leaf and amalgam) were presented, as well as ancient and modern patination processes. Special attention was devoted to decay, discussing corrosion mechanisms and alteration patinas as a result of outdoor/indoor exposure. Some conservation strategies were also presented, showing several examples of published studies.

X-Ray Fluorescence spectroscopy (XRF): on site applications

An on-site experience at the Abbey of Saint Miniato al Monte (Florence) was offered, showing the application of X-ray fluorescence spectroscopy to the characterization of pigments. This activity was carried out in the framework of an ongoing Italian project for the restoration/conservation of the wall paintings by Paolo Uccello in the Cloister of the Abbey. After a first presentation of historical issues and conservation needs of the site, offered by the restorers involved in the project, non-invasive measurements were performed with ICVBC's XRF portable instrument to discover the colour

palette of the artist. Special attention was devoted to explain the diagnostic approach followed. Different pigments were found such as orpiment, lead and tin yellow, green earth, azurite.

ANTONIO SANSONETTI

CNR – ICVBC, Lecturer



BIOSKETCH

Antonio is researcher at ICVBC CNR since 2001. He's a chemist graduated at State University in Milan.

He works in Cleaning systems and Mortar characterization. He has a skilled experience in laser cleaning effects and in gel cleaning, having studied recently Agar gels. He drafts protocols to evaluate the effects of conservation systems on Architectures. He is Professor at Milan Polytechnic and Brera academy of Fine Arts in Milan. He is coordinator of the Working Group 3 UNI Cultural Heritage on the topic of Conservation treatments. He's author of more than 150 publications among peer reviewed articles and National and International Proceedings.

Abstract

The classes in Diplomazia2 regarded the following topics:

- Stone decay mechanisms and morphology: the ICOMOS Glossary
- Cleaning and conservation treatments: products and methods

As it is possible to observe the two topics are very broad, but crucial in the professional life of every person involved in Cultural Heritage Conservation and Valorisation. The first topic was aimed at recognize the decay forms on natural and artificial stones, including a possible hypothesis about the decay causes and mechanisms. A large set of images was used in order to allow the students to enlarge their personal experience about decay morphologies. A basic explanation on the chemical-physical transformations involved in the illustrated decay morphologies, has been given.

The second topic illustrates the main system used to conserve architectural surfaces, and in the specific cleaning, surface consolidation, water repellent treatments. This issue constitutes a platform to be shared with conservators, both in the museum and in site.

Both the topics have been highlighted in depth during a two day “promenade” through the main historical architectures in Milan, observing *de visu*, both decay patterns and the effects of recent conservation sites.

The discussion during the class and the surveys, was rich and a tasty occasion also for me to have an idea about the approach to conservation in other Mediterranean countries out of Italy.

ELEONORA MARIA STELLA

CNR – ICVBC, Tutor



BIOSKETCH

I graduated in Humanities - Art History Major at the Università “La Sapienza”, Rome (1987-1993). In 1996 I received my Three-year Master’s in Art History. Between 1988 and 2002 I was involved in several restoration projects working on mosaics, mural paintings, frescoes, stone surfaces of historical buildings and on easel paintings. Since 2005 I have been working at CNR - Institute for Conservation and Valorization of Cultural Heritage (ICVBC, Rome) concerning the following main activities: management and organisation, as an editor, of the multidisciplinary and international journal "Journal of Cultural Heritage" published by CNR and Éditions Elsevier (Paris) both in printed and electronic version. My area of expertise falls within history of art (mannerism style and baroque style), with special interests in safeguard, restoration and preservation (history), museography and museology, scientific and electronic publishing.

Abstract

After a general overview of the roman Villa of Cottanello (Rieti, Lazio), I showed the different methods employed to clean the rich mosaics decorating the villa floors, also addressing the aspects connected to the mosaics’ materials. In addition, some experimental tests, previously carried out on the stone, were presented.



SILVANA DI PAOLO

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Archaeologist and Art Historian of the Ancient Near East. Her main research interests cover the archaeology and art history of Mesopotamia and Syria on the one hand, and of ancient Cyprus on the other hand (3rd-1st millennia BC). She has participated in numerous excavations and researches in the Mediterranean and Middle Eastern countries (Iran, Syria, Lebanon, Cyprus). Actually she coordinates projects in Georgia and Iran, as well as researches in collaboration with CNRS. Her work focuses on crafts in the artisanal and visual culture shared among the Ancient Near Eastern polities. She has written extensively on the relationship between art and power, location and styles of workshops, and social meaning of works of art. Since many years, she also works on ancient Near Eastern collections in Italian museums, in order to understand the interconnections of heritages and identities. She is currently working on the concept of similarity in assemblages of artefacts and routinisation of the artisanal production in the Ancient Near East.

Abstract

Archaeology and history of the Ancient Near East: the origins and the Bronze age.

Starting with the analysis of the different historical geographical terms (Syria-Palestine, Levant, Canaan etc.) used in the research literature to indicate a large area which today comprises the modern states of Western Syria (west of the Euphrates valley), Lebanon, Israel, Jordan, and Cyprus, as well as the archaeological periodisation and the anchoring of relative chronology to a system of absolute dating, this lesson, focused on the time period between the Neolithic and Late Bronze Age, is a comprehensive overview of the settlement pattern, architecture, mortuary practices and material culture.

TATIANA PEDRAZZI

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Archaeologist of the Ancient Near East

Abstract

Archaeology and history of the Ancient Near East: the Iron age in the Levant.

This lesson had the aim to present the specific cultural framework of the Levantine coastal region, during the first half of the 1st millennium BCE. The early stages of this period represent a very complex and challenging historical phase. The emerging of some new distinctive cultural "identities" or "peoples" (such as Phoenicians, Israelites, Arameans, and so on) has been discussed, adopting a critical approach. Basic aspects of the Levantine material culture has also been described.

SILVIA ALAURA

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Archaeologist and philologist of Anatolia

Abstract

Archaeology and history of preclassical Anatolia

Aim of the seminar was to provide a useful, up-to-date, general overview of the vast and complex field of Hittite studies by providing highlights on several key issues based on new developments and approaches from historical, philological and archaeological points of view. The subjects discussed include history, state and society, environment and economy, foreign contacts, cities, temples and sanctuaries, warfare and written legacy, bringing the results and the evidence of different fields together (history, philology, archaeology and natural sciences). The time-frame extends from the period of the Old Hittite kingdom in the 17th century BC to the end of the Hittite Empire in the early years of the 12th century BC. One of this seminar distinguishing characteristics is its interdisciplinary approach (archaeology, ancient and modern history, the history of ideas, philosophy, anthropology).

History of Collecting and the Reception of Oriental Studies in modern European Societies.

The seminar focused on the history of archaeological, philological and historical studies of the ancient Near East, and their reception in contemporary and modern society. The topic was highlighted by examples from the life and the scientific activities of archaeologists and from the history of museums and academic institutions they belonged to. Further examples deal with the historical, political and socioeconomic contexts in which the archaeological explorations of the Near East took place and their reception by the European public (nineteenth century melodrama, twenty century architecture). One of this seminar distinguishing characteristic was its interdisciplinary approach (archaeology, ancient and modern history, history of ideas, philosophy, anthropology).

MARCO BONECHI

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Assyriologist, expert in cuneiform texts

Abstract

Cuneiform writing.

Introduction to the invention, inner development, international diffusion, decline, and end of the cuneiform writing, with notes on its geographical and historical setting, and on the many languages written in cuneiform. Remarks on the formation, rank, and duties of the persons who wrote cuneiform, i.e. the scribes, with observations on the scribal schools, on the many supports on which it was inscribed, and on the public display or private use of it. Discussion of how and why the peculiar features of this script contributed to the administrative activities, the political life, and the intellectual achievements of the most important pre-classical cultures of the Near East. Presentation of the main scholarly tools used today to master the cuneiform writings and the languages recorded by means of it.

LUCIA ALBERTI

CNR – ISMA, Coordinator and Lecturer



BIOSKETCH

Researcher, Archaeologist, specialised in Mediterranean Prehistory and Greek Bronze Age (3rd-2nd millennia BC). She is specialised in the study of Minoan Crete and its relations with the Mycenaean world. She works in particular on burial customs and on identity and ethnicity concepts in Mediterranean Prehistory. She is currently Director of the Italian team of the Joint Archaeological Laboratory CNR-Historical Institute of Montenegro applied to the ancient site of Doclea, Montenegro.

Abstract

Archaeology and history of the Greek Bronze age.

After a general overview on absolute/relative chronologies and terminologies of Aegean archaeology, the lesson focused on the emergence of complex societies in the Aegean basin during the III millennium BC and of palaces structures both in Crete and in mainland Greece in the II millennium BC. Settlements and palaces, necropoleis and burial customs, pottery production and artefacts, trade and people movements has been analysed, with a specific attention on interconnections between Aegean human groups and other Mediterranean Bronze age civilisations. Special attention was paid to the

importance of the findings of Mycenaean/Minoan pottery in no-Aegean contexts for the building of a Bronze Age common chronology.

MAURIZIO DEL FREO

CNR – ISMA, Lecturer



BIOSKETCH

Researcher at ISMA, expert in Aegean and Cypriot epigraphy and member of the Italian Society of Glottology. His main interests are about Linear A and Linear B texts. In this field he is involved in several editorial projects, including the supplement volume to the Corpus of the Linear A inscriptions (with J. Zurbach, ENS, Paris) and the digital edition of the Linear B documents (with F. Di Filippo, ISMA). He is author of a monograph on the Linear B land registers, co-author of the edition of the Linear B texts from Thebes (with V. Aravantinos, L. Godart and A. Sacconi) and co-editor of a Handbook of Mycenaean Epigraphy (with M. Perna, SOB, Napoli). He is member of the editorial boards of various scientific journals (Minos, Pasiphae, SMEA n.s.) as well as co-editor of the "Incunabula Graeca" series (with M. Bettelli, ISMA).


Abstract

Aegean writings of the II millennium BC.

The lesson focused on the three main Aegean writings of the II millennium BC (Cretan Hieroglyphics, Linear A and Linear B). The historical relationships between the three writing systems has been illustrated and the problem of their origins considered. The findspots of the inscriptions and their archaeological contexts have been briefly analysed as well as their typologies and functions. A quick reference has also been made to the authors of the inscriptions (the scribes) as well as to the importance of the palaeographic studies. Finally, a number of Linear B texts have been presented and commented upon in order to show their importance for the reconstruction of the Mycenaean palatial civilisation. A handout and a short bibliography have been made available after the lesson.

MARCO BETTELLI

CNR – ISMA, Lecturer

	<p>BIOSKETCH Researcher, Archaeologist of Italian Bronze and Iron ages.</p>
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Abstract

Aegean and Southern Italy; South central Italy.

Bronze Age and Early Iron Age in Italy: general outline of the Italian protohistory, especially concerning material culture and chronology; settlements and territory; funerary customs; exchange networks and Mediterranean interrelations. Practical lessons were conducted through visits to sites and Museums: in particular at Palatino, Foro romano and Museo Nazionale romano, with a specific focus on the origins of the city of Rome.

ANDREA DI RENZONI

CNR – ISMA, Lecturer

	<p>BIOSKETCH Researcher, Archaeologist of Italian Bronze and Iron ages.</p>
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Abstract

North central Italy: Cultural aspects, Economic strategies and social organizations during the second millennium BCE.

The development of forms of social organization in Italy during the period between the Early Bronze Age and the beginning of the Late Bronze Age (ca.

2200-1150 BC) shows a clear trend towards more structured and hierarchical forms of social and political organization. Analysing the main archaeological evidence of recent years, the earliest forms of inequality – i.e., based on established forms of economic differentiation, and not only on rank – are visible at the threshold of the Recent Bronze Age, at least in some regions.

ALESSANDRA PIERGROSSI

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Archaeologist, Alessandra Piergrossi works on issues relating to the central Tyrrhenian area, in particular Lazio and Etruria from the Iron Age to the Archaic period. She has conducted research on the structure and material culture of settlements (Ficana, Veio) and more recently her interests have focused on Etruscan funeral rites and customs. Since 1996 she has been part of the scientific direction of the archaeological research of the University of Rome La Sapienza, at the site of Piazza d'Armi at Veii and leader of the project team responsible for the publication of the archaic necropolis of Veii. In parallel to and complementary with the funerary analysis she is working with a team from the Rome Superintendence to study the vast territory located between Rome and Veii, taking this as an observatory for the study of structures and aspects of the political, social, economic, religious and cultural activity which characterised proto urban development.

Abstract

Iron Age and Orientalizing period.

At the beginning of the Early Iron Age, the organization of Etruscan from Villanovan villages evolved into proto-urban sites, through a fast process of aggregation. A growing interest in seafaring activities can be traced by the evidence of frequent contacts with other populations from the area of the Tyrrhenian Sea, prior to the pivotal encounter with the Greek and Phoenician worlds. The funerary evidence (9th century BC) reveals an apparently egalitarian society, in which almost no reference to the status of the dead appeared in burials. Since the early 8th century BC, a progressive increase in

wealth together with the display of symbols of political and religious power is evident and tomb-groups reveal the image of a hierarchical social structure. During the Orientalizing phase (ca. 730-580 BC), Etruria participated in a widespread cultural phenomenon that encompassed the entire Mediterranean basin, with displacement of people and circulation of prestige goods and ideas, introduced into the West along from Egypt, the Aegean and the Near East.

LAURA AMBROSINI

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Etruscologist.

Abstract

Italian peninsula: From VI to II cent. BC.

In the lecture the principal historical events, the main society characteristics, the architectural remains and the archaeological evidences between VI and II century B.C. with particular reference to the Etruscan civilization and its contacts with pre-Roman civilizations (especially with the Latins and the Romans) has been presented. The Archaic, Classical and Hellenistic ages are very important historical periods during which the Etruscans faced fierce wars for the supremacy in the Tyrrhenian Sea. During the same periods they came into contact with different civilizations and many foreign craftsmen settled in Etruria contributing from time to time to the technical and stylistic innovations of the Etruscan productions.

ENRICO BENELLI

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Etruscologist

Abstract

Languages and writings of Ancient Italy.

Language is probably the most evident element distinguishing the various human groups living in Italy during the I millennium BC. In defining their specific cultural habits, these human groups, which were to become known as "peoples", developed also quite distinctive epigraphic cultures. A brief overview of this complex pattern of languages and writings from a diachronical and diatopical point of view has been presented.

MASSIMO BOTTO

CNR – ISMA, Lecturer and Director of excavation



BIOSKETCH

Senior Researcher, Archaeologist of Phoenician and Punic civilizations, Director of the excavations of Pani Loriga in Sardinia


Abstract

Phoenician and Punic western Mediterranean: Indigenous communities and Phoenicians in Sardinia.

From the 8th century BC the Phoenician presence in Sulcis is characterized by wide territorial control, from the mother colony of Sulky, on the island of Sant'Antioco, to the innermost parts of the region. Such control was structured through different types of settlements, organized in a hierarchical manner. After an early stage, when interactions with the local communities developed principally along the coast, followed a thrust towards the inner regions with the foundation of the colony at Monte Sirai at the end of the 8th century BC. A new push can be seen in the later second half of the 7th century BC with the creation of a real defensive system centred on Monte Sirai and its new colonial foundation of Pani Loriga. In this period we find the foundation of the Nuraghe Sirai fortress and some Phoenician settlements in traditional Nuragic centres, such as Sirimagus and Tratalias.

LORENZA-ILIA MANFREDI

CNR – ISMA, Lecturer

	<p>BIOSKETCH Senior Researcher, Archaeologist of Phoenician and Punic civilizations</p>
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Abstract

Phoenician and Punic North Africa.

Introduction to Phoenician and Punic North Africa. Phoenician settlements and their archaeological and epigraphic remains. Carthage and its imperialistic project: administration, society, religion. North Africa after the fall of Carthago, the independent cities and numismatic. 2. Economy in Punic North-Africa. Focus on local archaeo-metallurgy. There are very few archaeological data about mineral basins of North Africa exploited in pre-roman age, the majority of ancient evidences dates back almost exclusively to roman time. However, it has to be remembered that searching for metals was one of the leading aim for Phoenician expansion to West, and that North Africa is one of the richest metal area of the whole Phoenician and Punic world.

IRENE ROSSI

CNR – ISMA, Lecturer

	<p>BIOSKETCH Researcher, Epigraphist of pre-Islamic civilizations.</p>
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Abstract

Expert in Semitic Epigraphy and pre-Islamic Arabia.

Arabia in pre-Islamic times was home to different sedentary and nomadic peoples who left tens of thousands of epigraphic texts in different alphabetic scripts and Semitic languages. These documents witness for a peculiar cultural identity which, at its turn, was fully integrated into the social and historical dynamics of the ancient Near Eastern and Mediterranean world.

The lesson focused on the rich documentation coming from the South of the Arabian peninsula, consisting of both monumental inscriptions and informal texts. This epigraphic heritage, which is at serious risk due to the instable political situation of the area, constitutes a significant case of study on the latest strategies developed for the preservation – and therefore study, valorisation and dissemination – of the fragile testimonies of our past. Various projects of digital treatment of the inscriptions of pre-Islamic Arabia were presented and discussed – focusing on the principles, methodologies, good practices and challenges of Digital Epigraphy.

PAOLA MOSCATI

CNR – ISMA, Lecturer



BIOSKETCH

Research Director, Archaeologist, specialised in Ancient Topography and computer applications in archaeology. She has conducted surveys and excavations in Etruria and in the Faliscan territory. Editor of the international open access Journal “Archeologia e Calcolatori”, she is the scientific coordinator of the international project “The history of archaeological computing” jointly promoted by the CNR and the Accademia Nazionale dei Lincei.

Abstract

Computer applications and Mediterranean archaeology.

Archaeological computing promotes the development of formalised procedures in order to represent, process and share archaeological data. In the 21st century, ICTs aim at supporting international digitisation policies for cultural heritage safeguarding and enhancement. From statistical analyses to Geographical Information Systems, from multimedia systems to Virtual Reality techniques, computer science offers an integrated platform for managing interdisciplinary methods and tools. A methodological review of case studies published in the international open access Journal “Archeologia e

Calcolatori” and related to the Mediterranean area demonstrated how computer technologies can exercise a profound impact on traditional research methods, thus contributing to record, illustrate and disseminate the past in new and original ways.

CARLA SFAMENI

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Archaeologist, specialist in Roman and Late Antique periods. Director of the excavations at the Roman Villa of Cottanello (Rieti).

Abstract

History and archaeology of the Roman site of Cottanello.

The aim of this seminar was to provide an overview of the historical and territorial context of the Roman villa of Cottanello in Sabina, a building with atrium, peristyle, bath suite and very interesting mosaics, dating back for its main phase to the first half of 1st cent. AD. The lesson focused on the history of the archaeological research since the discovery in the '60 to the more recent and still in progress interventions of ISMA and other CNR Institutes (archaeological excavations and diagnostic support to the study of the site and the materials).

From excavation to local people perception: the example of Cottanello.

Guided visit to the archaeological area of the Roman villa of Cottanello and the archaeological storeroom. Presentation of the CNR interdisciplinary activity for the knowledge, conservation and valorisation of the site, in collaboration with the Superintendence of Cultural Heritage and the Municipality of Cottanello.

Analysis and management of archaeological materials after excavation.

This practical activity had the aim to analyse the different categories of materials that are found in an archaeological excavation and the related

classification, cataloguing and documentation systems. Some specific classes of archaeological material has been analysed with practical training.

VINCENZO BELLELLI

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Archaeologist of Preroman Italy, Etruscologist.

Abstract

History and archaeology of the Etruscan site of Cerveteri.

The aim of this seminar was providing the audience with an overview of the historical and territorial context of the Etruscan site of Cerveteri (ancient Caere). The main focus of the lessons was therefore the topography of Caere, with particular attention to the urban area, which is the object of an institutional project of the CNR-ISMA. Several sites of the Caere 's urban plateau have been analyzed, such as the Vigna Parrocchiale, the S. Antonio's sanctuary and the Manganello's sacred area. Moreover, the problem of the defensive walls facing the northern side of the hill has been analyzed, providing elements of chronology. Finally, some information has been provided on the road system of both the urban area and the extraurban territory.

GIUSEPPE GARBATI

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, his main interests are focused on the Phoenician culture. Owner of the research line “Cult and identitarian construction of the western Phoenicians. Geographical, Cultural and Symbolic Borders”, he directs together with Tatiana Pedrazzi (ISMA) the project “Transformations and Crisis in the Mediterranean. 'Identity' and Interculturality in the Levant and the Phoenician West”. Member of the Editorial Board of the Rivista di Studi Fenici and of the Scientific Committee of the Journal SPAL monografías, he is author of several scientific contributions, including the monograph “Religione votiva. Per un'interpretazione storico-religiosa delle terrecotte votive nella Sardegna punica e tardo-punica” (Pisa-Roma 2008). He currently participates in the archaeological mission at the Phoenician and Punic site of Pani Loriga (Santadi - Sardinia), directed by Massimo Botto (ISMA) and collaborates on the project “El tsunami en las representaciones culturales del mundo antiguo: Gadir-Gades y el Golfo de Cádiz como caso de estudio” (HAR 2015-66011-P) and on the workgroup “Pour un nouvel Orient ancien. Prolégomènes au Traité d'Anthropologie historique” (INALCO, Paris).

Abstract

From excavation to present people perception: the example of Cerveteri.

The Etruscan necropolis of Cerveteri that together with its museum is included since 2004 in the UNESCO World Heritage List, is undoubtedly one of the most important testimony of the Etruscan culture. It has its own specific characteristics, reflecting the formation and the development of two different communities, certainly related but strongly autonomous in the cultural manifestations that marked them. It stands out for the monumentality of the tombs and the variety of their typologies, inserted in a “true city of the dead”, which incorporates, in some way, the conception of a urban fabric. The visit of this archaeological site, with the specific peculiarities and along with the

related museum collection, gave way, therefore, to the possibility to deepen primary and different aspects of the southern Etruscan culture.

ANTONIO D'EREDITA'

CNR – ISMA, Lecturer



BIOSKETCH

Technologist, Architect

Abstract

Graphics reconstruction of ancient materials.

Computer graphics in collaboration with archaeology makes possible to visualize models of ancient buildings and artefacts, place them back to their original location and orientation, illuminate them, such as they would have appeared many years ago. Recent advances in computer graphics, such as high performance hardware, tools for efficiently handling data, should now enable virtual archaeology to become a valuable tool to assist archaeologists in their interpretation of the past. These lessons shortly described the practical methodology adopted in order to create a faithful reconstruction and realistic material and lighting simulation of ancient finds. The issues include constructing an accurate geometric model, providing detailed surface materials and textures, determining the properties of the materials, and rendering the model with physically correct lighting. The goal of this work was searching for accuracy, avoiding the very real danger of misrepresenting the past.



BIOSKETCH

Researcher, Archaeologist, expert in methodology and informatics of archaeological sciences

Abstract

Collecting antiquities: the case of Collezione Faina.

The subject of the lesson was the story of the rich collection of antiquities gathered by the counts Mauro and Eugenio Faina from 1864 and now kept in the Claudio Faina Museum in Orvieto, opposite the famous cathedral. The collection contains different objects: protohistoric and prehistoric finds, Etruscan and Greek vases, bronzes, ancient coins, etc. They come from Umbrian and Tuscan antiquities market and from the excavations carried out at that time in the Orvieto necropolises, mainly from Crocefisso del Tufo cemetery. Particular attention has been paid to the analysis of the bronzes collection, which date from the Bronze age up the Roman period, especially votive bronzes and vessels. To bronzes is also dedicated a specific website with database, named ‘Sethlans. Bronzes of the Faina Museum’: <http://bronzifaina.isma.cnr.it/>.

Through the history of the collection some general features of Nineteenth-century collections has been also highlighted.

DIEGO BALDI

CNR – ISMA, Lecturer



BIOSKETCH

Technologist, expert in bibliographical and archives sciences.

Abstract

Collecting books: private libraries and new approaches to archives and bibliographical studies.

The private libraries of archaeologists could be of great help for the comprehension of some of the most important scholars, their lives, their paths of research, their interests and their studies. The private libraries of Massimo Pallottino and Giulio Cesare Bruto Teloni has been illustrated. Both of the libraries, as it will be shown, could give a good piece of information about the two archaeologists, their activity and their way to do research.

IDA OGGIANO

CNR – ISMA, Lecturer



BIOSKETCH

Researcher, Archaeologists of Phoenician and Punic civilizations

CANDIDA FELLI

CNR – ISMA, Lecturer



BIOSKETCH

Associated Researcher, Archaeologist of Ancient Near East

Abstract

Visit the to Oriental Section of Musei Vaticani.

<http://www.museivaticani.va/>

The Museo Egizio of the Vatican Museums includes a large collection of Egyptian Antiquities as well as a smaller but significant corpus of Near Eastern pieces. During the visit the students were enabled to have a close encounter with different aspects of two of the most ancient civilizations of the world, starting from the sculptural reliefs of the Neo-Assyrian palaces, across Levantine pottery and weapons as well as Mesopotamian seals and texts, and reaching out statues, coffins and stelae of ancient Egypt. Aim of the visit was to provide the rare experience of approaching these two closely related cultures within the same museum context and to get acquainted with the history of collecting behind it.

ANDREA ANGELINI

CNR – ITABC, Lecturer



BIOSKETCH

Archaeologist, graduated in Letter at the Sapienza - University of Rome with a thesis in Survey and Technical Analysis of the Ancient Monuments, in 2010 earns the Specialization in Classic Archaeology. Ph. D. in 2016 at the Department of History, Representation and Restoration of Architecture, he currently holds the qualification of researcher at ITABC-CNR in Rome.

Abstract

The course was focused on the use of the GNSS systems in Archaeology. It was divided in 2 different parts; the first part concerned the general theory and applications for improving the knowledge about principles for the correct use of the instrument. The second part was dedicated to the experimentation activity on the field for testing different modes and data acquisitions.

The entire scope of satellite systems used in positioning is now referred to as global navigation satellite systems (GNSS). Receivers that use GPS satellites and another system such as GLONASS are known as GNSS receivers. These systems provide precise timing and positioning information anywhere on the Earth with high reliability and low cost. The systems can be operated day or

night, rain or shine, and do not require cleared lines of sight between survey stations. This represents a revolutionary departure from conventional surveying procedures, which rely on observed angles and distances for determining point positions.

The lessons were intended to make conscious the user with the problems of the GNSS systems in topography and archaeology. In addition to general information, particular attention was dedicated to the technique known as Differential GPS. The DGPS is based on the use of twin GPS for reaching very accurate information about the position of the points. Thanks to this mode in archaeology it is possible to make very accurate survey of ancient buildings and the digital representation of the terrain (DEM) for studying the anomalies.

CINZIA BACIGALUPO

CNR – ITABC, Lecturer



BIOSKETCH

Arch. Cinzia Bacigalupo, is a researcher at CNR - Istituto per le Tecnologie Applicate ai Beni Culturali (ITABC), Rome. Her main activity is the application of digital techniques to the geometric survey and the photogrammetry. She studies integrated systems of measurement and monitoring, based on geodetic and photogrammetric techniques, to be used for the storage of the information on historical buildings, monuments and archaeological sites. She has contributed to develop methodologies for the survey, that have been applied in several case studies both in Italy and abroad. All this is finalised to the development, conservation and proper management of the cultural heritage. She has contributed to the proposal and realization of projects within the framework of the European Union programs. The results of her activity has been the object of several publications and invited talks at national and international conferences.

Abstract

“Techniques and tools for survey”

The techniques for the topographic survey of an artefact or an archaeological excavation have been presented. Traditionally, topography is one of the components of geomatics, the discipline of gathering, storing, processing, and delivering geographic information or spatially referenced information. on Earth, environment and cultural heritage.

The topics of the have been :

- the survey introduced as the set of observations used to measure and to describe “geometric items” such as archaeological excavations, buildings, etc.
 - the basic concepts of the 2D and 3D reference systems and the units used in topography (angles and distances)
 - the operation and basic concepts of functioning of the total station or TST (total station theodolite), the integrated electronic / optical instrument used nowadays in the geomatics, which performs an electro-optical measurement of the distance (EDM) and save the data in internal/external units
 - Topographic framing with polygons and point networks
- examples of topographic mapping from the design to the materialization of the stations' vertices, to the monographs of the points taken.

During the training part of the course , students performed a topographic survey and acquired the topographic points of a study case (ITABC building).

Lessons made with the collaboration of Leti Messina Tommaso of ITABC.

EMILIANO DI LUZIO

CNR – ITABC, Lecturer



BIOSKETCH

Since 2009 he is a researcher at CNR-ITABC, (i.e. Institute for Technologies applied to Cultural Heritage). From March 2012 to May 2017 he has been the Scientific Coordinator of the FIRB project “The landscape of a main roman road: a multidisciplinary approach for the diachronous reconstruction of the Via Appia at the Aurunci pass”. He has published several scientific articles including papers on national and international journals, volumes and congress proceedings in the field of Geology, Geoarchaeology and Geomorphology.

Abstract

The definition of 2D and 3D geological models for the evaluation of geohazards in archaeological sites and urban areas. Application of passive seismic techniques in urban areas.

Lessons were focused initially on main principles of rock classifications, sequence stratigraphy, tectonics and surface processes in order to get Diplomazia students accustomed to basics ideas of Geology.

Then, the Pleistocene-Holocene geological and geomorphological evolution of the Roman area was illustrated to better frame the possible interactions between geological processes of different origins (marine deposition, fluvial dynamics, volcanism, tectonics, landslide processes, sea level variation). In addition, such geological aspects were discussed in terms of advantage and disadvantages for site occupation and civilization development; the case of the Palatine Hill in downtown Rome was described in detail as a clear example of the main role played by geological factors and geohazards in influencing anthropogenic activities.

Successively, the attention was dedicated to principles of soil dynamics with a particular care to earthquake-generated site effects in alluvial terrains and double resonance effects between soft terrains and structures such as modern building and monuments. A wide spectra of case histories was illustrated, depicting also the seismic history of Rome and surrounding region. The intensity distribution maps related to main seismic effects felt in Rome during the 2009 L'Aquila sequence was discussed.

Finally, during a practical lesson taken in the Montelibretti research area, the DIPLOMAZIA students experienced field recordings of environmental noise (passive seismic) trough a tromograph in a single station array. Data were then

elaborated by students following the HVSR (Horizontal to Vertical Spectral Ratio) technique for the determination of the first-order resonance frequency of subsoil.

Lessons made with the collaboration of De Meo Anna of ITABC.

ANDREA DI SOMMA

CNR – ITABC, Lecturer



BIOSKETCH

Andrea Di Somma is a geographer and cartographer, working as a technologist at CNR's ITABC. He was formed between Rome, Seville and Madrid where he obtained his Diploma of Advanced Studies in "Regional Geographic Analysis and Physical Geography". He is the creator of AGAT for whom he has been working for 8 years. His research perspectives concern: neogeography; the study of natural areas, for the protection of cultural and environmental assets; land use and multitemporal analysis applications.

Abstract

GIS for cultural heritage, alternative methods GIS, unconventional practices to traditional cartography, neo-geographical techniques and free tools and/or open source, to enhance the study and the fruition of cultural heritages.

Neogeography is the use of geographical techniques and tools for personal and community activities or by a non-expert group of users. Application domains of neogeography are typically not formal or analytical.

From the point of view of human geography, neogeography could be also defined as the use of new specific information society tools, especially the Internet, to the aims and purposes of Geography as an academic discipline; in all branches of geographical thought and incorporating contributions from outside of Geography performed by non-specialist users in this discipline through the use of specific geographic ICT tools. This new definition, complementing previous ones, restores to academic Geography the leading role it should play when considering a renewal of the discipline with the rigor and right granted by its centuries-existence, but also includes the interesting social phenomenon of citizen participation in the geographical knowledge from its dual role: as undoubted possibility of enrichment for Geography and as social phenomenon with geographic interest.

The interest of the public to neogeography has grown in recent years thanks to the simplification of geographic information production that is spread by the Web 2.0 (now Web 3.0 technologies multifunctional geographic mapping offers), such as Google Maps, Google Earth, and OpenStreetMap, together with the fall in prices of portable GPS devices. Subsequently, the use of geospatial technologies was integrated with not specifically geographical applications, entering in daily use through, for example, the applications of modern mobile phones called smart phones, such as those for Android.

Historically, geographic information systems (GIS) have developed tools and techniques for formal and professional applications requiring precision and accuracy. In contrast, neogeography tends to spread more accessible and familiar applications to "non-experts". These two areas can overlap so giving the opportunity to face the same problems in two different user groups: experts and non-experts.

Neogeography has also been connected with the increase in user-generated geographic content, closely related to Volunteered Geographic Information. This can be active collection of data such as OpenStreetMap or passive collection of user-data such as Flickr tags for folksonomic toponyms.

DANIELE FERDANI

CNR – ITABC, Tutor and Lecturer



BIOSKETCH

PhD in Archaeology and 3D artist. Graduated in Preservation of Cultural Heritages at the University of Parma in 2006 and attained a postgraduate master of research in Geo-technology for Archaeology at the University of Siena in 2007. In 2012 a PhD in Medieval Archaeology at University of Siena specializing in surveys, analysis, representation and 3D reconstruction of medieval architectures and settlements. Since 2011, he has been working as researcher at CNR-ITABC, Rome (VHlab). His research involves: archaeological survey using image-based and range-based techniques; 3D modeling of archaeological manufacts and sites; virtual museums and dissemination of cultural heritage through digital technologies. Since 2013 he has been teaching "virtual archaeology and 3D visualization for the virtual interpretation and analysis of archaeological contexts" as guest lecturer at the master courses "Virtual Reality in Archaeology" of the Lund University (Sweden), Institutionen för arkeologi och antikens historia dept.

Abstract

Photogrammetry, traditional and dense stereo matching. Basic Principle, available software solutions, step-by-step instruction. 3D Reconstruction. Introduction to Computer Animation.

During the lessons I dealt with different main topics of the computer graphic, from 3D reality-based reconstruction for archaeological documentation to cultural heritage dissemination through digital technologies, in order to give students a wide overview on the matter. I started from the basic of computer graphic describing what is virtual reality and 3D models and then I explained the processes which allow tridimensional objects to be created and their different fields of application within the Cultural Heritage domain. Concerning reality-based modelling, I described different acquisition methods (range-based and image-based) and tools (laser scanner, digital camera, laser total station, UAV) illustrating, with the support of case studies, practical applications, workflow and possible outputs. During a practical lesson, the student also experienced the entire workflow of the dense image matching (DSM) technique by using a laser total station and a digital camera. Step-by-step, I showed how to use the tools to survey a small object. Afterward, we processed together the digital data with a DSM software to get a digital replica of the object. About computer graphic and animation, I illustrated theory and best practice of 3D models and 3D reconstruction of historical sites and manufactures in archaeology with the support of VHLab projects as case studies. I taught the basis of 3D polygonal modelling and texturing using the software *Blender* and the students experienced how to create digital objects using archaeological references. Finally I gave a lecture on what is a virtual museum and how to develop it according to the most recent researches. I showed different virtual museums and digital libraries as case studies in order to demonstrate how 3D models can be successfully used for cultural dissemination and preservation. In particular I illustrated new possibilities of museum contents fruition by means of new technologies. I showed different applications developed by ITABC VHLAB for museum exhibitions (such as: *Keys to Rome, Avars Revived, Tiber Valley Virtual Museum and Genus Bononiae*), from augmented and virtual reality, holograms and natural interaction, to mobile app, projection mapping and immersive devices.

ROBERTO GABRIELLI

CNR – ITABC, Lecturer



BIOSKETCH

Graduated in Physics. Research in the field of Geomatics.

Leadership roles in 3 international missions.

Hobbies: Photography; Technology; Cooking; Travel.

Sport: Football; Tennis; Walking; Swimming.

Abstract

Lessons have been focused on the learning of architectural and archaeological survey. In particular, topics related to Laser Scanner technologies and photogrammetric methods were dealt with particular attention to methods based on the "Structure of Motion" algorithm.

Some simple hints about processing RAW frames have been introduced. The concepts of spherical panoramic shots have been introduced as a useful laser scanning integration tool.

Practical lessons were conducted mainly at the headquarters of the CNR Rome Research Area 1 with some simple instrumental TESTS. Lastly, an excursion was organized at the Regional Park of Marturanum (Barbarano Romano). During this excursion, the trainees were able to learn many geological and natural features of the park with a little presentation held by the director of the Park, Dr. Stefano Celletti. During this excursion the participants could see some of the Etruscan Rocks in the park. The main part of life is culminated in the medieval church of San Giuliano, where the participants conducted a photogrammetric survey and a laser scanner pad survey of the monument. Some of the participants in the following days made a request to be able to perform the hours of the processing lessons, out of these surveys.



BIOSKETCH

Researcher at the Institute of Technology Applied at Cultural Heritage of the National Council of Research of Italy, where she works on conservation and regeneration of architectural heritage. She holds a BA in architecture and a specialization in restoration of monuments. She has more than 25 years experience in research programmes, as well as project management, definition of R&D and technology promotion strategy conservation. She is responsible of the BHLab of the Institute and Head of the Research Unit of Naples. Her researches arise from the objective to integrate the application and development of new diagnostic techniques and important historic buildings with the deepening of conservation design strategies for a "comprehensive model of knowledge and conservation of built heritage."

Abstract

1. Sustainable conservation for historic buildings and city centres.

This module deals with sustainability strategies for historic buildings and city historical centers and focuses on Sustainability and Energy Efficiency and Cultural Heritage. Critical solutions that meet present requirements for heritage management, preservation, conservation and use, taking in account the future needs of the communities of the built environment. Traditional building materials and their properties, better understanding of degradation of ancient materials and structures, possibilities, limits and risks of conservation materials and techniques. Techniques, tools and best practices for energy efficient retrofitting of heritage buildings. Heritage BIM for conservation and management of the built heritage.

2. BPS Building Performance Simulation for the Sustainability and Energy Efficiency of the Built Heritage

Introduction: Sustainability, Energy Efficiency and Cultural Heritage. Decision support and non destructive diagnostic through numerical simulation.

3. "SMARTPOLIS" ©. The role of Heritage sustainable preservation in urban regeneration.

The module explores possibilities of development strategy for a Smart ancient city not only in terms of policy, urban spaces and squares,

mobility, water, green, energy, environment but also considering the use of older buildings as spaces of opportunity for new urban activities, including local area physical renovation, economic revitalisation and demographic-social change

International case studies about methodologies and best practices in urban renovation of historical cities: from governance strategies about cultural heritage management to urban, architectural and technological devices to renew public spaces in order to make historical cities livable in a compatible way with their past and in a sustainable way for their future.

4. "APPROACHING RESTORATION". Theory and history of restoration, contemporary developments and debate, case studies, field survey.

The module aims to provide an updated framework for the theory and history of restoration, starting from the first reflections to the current debate, up to the widespread positions of the main schools. The module consists of three specific appointments:

- lecture on theory and history of restoration, contemporary developments and debate, case studies and different contemporary approaches.
- visit to the restoration site of the Palaces of Domiziano and Adriano on the Palatino hill with ing. Giovanni Cangi describing structural consolidation intervention.

With the precious contribution of:

Filippo Calcerano, Giovanni Cangi, Luciano Cessari, Bruna Di Palma, Maria Grazia Filetici.

AUGUSTO PALOMBINI

CNR – ITABC, Lecturer



BIOSKETCH

Archaeologist, researcher at CNR-ITABC. Born in Rome in 1971. PhD in African Studies at University of Naples L'Orientale (2004). Worked with archaeological missions in Italy and Africa (Sahara Desert). Author of scientific papers, dissemination works, two historical novels "Dietro la sabbia" (Aletti, 2000) and "Il cammino ell'imperatrice" (Limina, 2004); two dossiers "Cervelli in fuga" (Brains on the run , Avverbi 2001) and "Cervelli in Gabbia" (Brains in the cage , Avverbi 2005). National Coordinator of the Italian PhD Association (2003-2007); founding member of the Italian Archaeologists Confederation (CIA). His research activity is currently focused on landscape

	<p>archaeology, virtual museums, digital storytelling, computer science and multimedia solutions applied to Cultural Heritage and topographic surveying, particularly dealing with open source software. Expert on Geographic Information Systems, with scripting activity and advanced teaching experiences. He's been involved in 6 European research projects, in the VII Framework Program and Horizon2020. He loves reading and playing guitar.</p> <p>BIOSKETCH</p> <p>Archaeologist, researcher at CNR-ITABC. Born in Rome in 1971. PhD in African Studies at University of Naples L'Orientale (2004). Worked with archaeological missions in Italy and Africa (Sahara Desert). Author of scientific papers, dissemination works, two historical novels "Dietro la sabbia" (Aletti, 2000) and "Il cammino dell'imperatrice" (Limina, 2004); two dossiers "Cervelli in fuga" (Brains on the run, Avverbi 2001) and "Cervelli in Gabbia" (Brains in the cage, Avverbi 2005). National Coordinator of the Italian PhD Association (2003-2007); founding member of the Italian Archaeologists Confederation (CIA). His research activity is currently focused on landscape archaeology, virtual museums, digital storytelling, computer science and multimedia solutions applied to Cultural Heritage and topographic surveying, particularly dealing with open source software. Expert on Geographic Information Systems, with scripting activity and advanced teaching experiences. He's been involved in 6 European research projects, in the VII Framework Program and Horizon2020. He loves reading and playing guitar.</p>
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Abstract

The lessons held in the course were focused on different aspects of the work in Cultural Heritage domain. The concept of “Virtual Archaeology” was described, taking into account the revolution occurred in the last 20 years, thanks to the computer graphics applied to the Cultural Heritage. New economic models are spreading in the changed environment, and new problems connected with autorship and reproduction have to be faced. At the same time, the archaeological remains, in shape of digital models, may be used in much more contexts than in the past. This implies also the use of new techniques for dissemination, above all the storytelling approach. They’ve been presented the main steps of the history of the narrative techniques, since Aristotle’ Poetics up to the present.

Another part of the course dealt with Geographical Information Systems. It started with a general introduction on digital cartography and cartographic principles (geographic reference systems, coordinate formats, etc.), then the student were trained with practical exercises in simple GIS activities, such as raster and vector file importing, visualizing and managing, thus having an approach to the main Open Source GIS software platform: QGIS and GRASS-Gis.

An analytical overview of a sample of the most recent virtual reconstruction works, both created by our Institution and other ones, completed the course.

EVA PIETRONI

CNR – ITABC, Lecturer



BIOSKETCH

Eva Pietroni is an art historian, a conservation specialist of Cultural Heritage and a musician.

Since 1998 she has been developing research activity in the Institute of Sciences and Technologies of Cognition and in the Institute of Technologies Applied to Cultural Heritage of CNR. She is a scientific responsible of projects of national and international interest at the Virtual Heritage Lab of CNR ITABC. The ambits of research and application are referred to the study, documentation, communication and valorization of Cultural Heritage, using the digital interactive technologies, with particular attention to the sector of real and virtual museum and virtual environments. She works in the virtual

reconstruction of the archaeological and potential ancient landscapes, of urban and monumental sites and artistic contexts. Different types of data, acquired directly on the field or coming from interpretative studies, are elaborated and integrated in VR ecosystems, where different levels of visualization, behaviors, multiuser dynamics, gesture based interaction are implemented, together with novel approaches in storytelling, where different paradigms converge, coming from Virtual Reality, Theatre, Cinema, Games, Augmented Reality.

She is an expert of the design of the users' experience (UX) inside real and virtual museums and carries on activities related to its evaluation as well. She realizes multimedia and virtual applications for several kinds of

	<p>technology, immersive or desktop systems, holographic showcases, mobile devices.</p> <p>She is author of cultural documentaries for the Italian National Television Rai3.</p> <p>Main projects:</p> <p>Casa dei Vettii in Pompei (2001-2005); Giotto's Scrovegni Chapel in Padova (2002-2003 Best paper award VSMM2002); Appia Antica project (2003-2005); Virtual Multiuser Museum of ancient Flaminia (2006-2008, 1° E-Content Award 2008); "Integrated Technologies of Robotics and Virtual environment in Archaeology project" (2006-2009, Best Paper Award VSMM 2008); Matera, tales of a city (2009-2012); "The Rule Confirmation": virtual experience among the characters of Giotto's work (2010); Etruscanning (European project, 2011-2013); The Virtual Museum of Tiber valley (2011-2015); Virtual Museum Transnational network (V-Must, 2011-2014); CEMEC european project (2015-2019); Ricostruzione virtuale delle terme di Egnazia (2015); Museo del territorio Irpino (2016-2017).</p>
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Abstract

The lessons will deal with some fundamental topics in the domain of cultural heritage communication: *Storytelling, direction, new contamination of media and body interaction in the virtual space*. They are essential part of the design of the user experience.

The great potential of digital technologies, the representation of an artefact with higher and higher level of resolution and metric accuracy, often translates in cold transmission were the narrative aspect is ancillary or even completely lost.

Storytelling, interactive or not interactive and built on a scientific base, is the real focus of communication of CH. Learning process, memorization, cultural transmission, motivation, affection are facilitated by an emotional experience of intimate enjoyment.

Fundamental components of storytelling are: 1) script/story, 2) visualization, 3) soundscape, 4) interaction. In the field of CH and virtual museums the state of the art of storytelling is in general very primitive, with few exceptions. In a good practice of cultural communication storytelling should be one of the first elements to be planned and defined, subordinate only to the definition of the

key concept, target and conditions of fruitions. Storytelling in fact determines the choices of languages, of communicative style, the light, the virtual camera behaviours, the soundscape, the rhythm, the level of interaction inside the virtual environment, the hierarchical organization of contents. Thus, storytelling establishes the need of a precise "direction", also in case of an interactive application or a virtual reality environment. Structuring this "direction", the designer will necessarily be induced to cross the traditional paradigms, creating novel approaches and communicative formats mixing techniques coming from of virtual reality, cinema, theatre and games.

Also the interaction and interface design are fundamental in the design of the user experience and during the lessons several examples have been presented, shown and discussed. Students have been guided to visit the Vatican Museums (Etruscanning) and the National Etruscan Museum of Villa Giulia (Virtual Museum of the Tiber Valley).

The challenge is really promising for young generations, as a possible vehicle of new competences and jobs and definitively for the development of a new industry.

SALVATORE PIRO

CNR – ITABC, Coordinator and Lecturer



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Salvatore Piro is a Research Director (geophysicist) at the ITABC Institute for Technologies Applied to Cultural Heritage, from 2010. He received his degree in physics (geophysics) from *La Sapienza* University (Rome, Italy) in 1979. Between 1981 and 1984 he was a Research Fellow at the Institute of Technologies Applied to Cultural Heritage (CNR-National Research Council – Italy), where he developed the acquisition, elaboration and interpretation techniques for Archaeological Prospection employing Magnetic, Geoelectric and Ground Penetrating Radar methods. Between 1984 and 1995 he was confirmed as a Researcher and from 1995 till 2010 he has been a Senior Scientist at the same institute. From 2002 to 2008 he has been Professor of Geophysics for Archaeology at the University *La Sapienza* (Rome, Italy) and from 2009 till present time he is Professor of Applied Geophysics at the Earth Science Department,

	<p><i>Sapienza</i> University of Rome. His research interests include the acquisition and processing of integrated geophysical methods for near surface investigations. He is a member of the following international societies: SEG, EAGE, Near Surface Geophysics, EGU, EEGS and ISAP. He is Associate Editor of the journals <i>Near Surface Geophysics (EAGE)</i>, <i>(Georadar and Archaeogeophysics)</i>, <i>Archaeological Propection, International Journal of Geophysics and Journal of Archaeology</i>.</p>
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Abstract

GRS-LAB Training Course

The GRS-Lab training course provides for a didactic section and a practical section, and has been basically realized in the “Area della Ricerca CNR di Roma1, Montelibretti”.

The didactic section includes both lessons and seminars and has been arranged in a dedicated room of the Institute “Library” (Biblioteca). The practical section is divided into: session on the field with acquisition instruments (GPS, FMD, GPR, ERT systems), interactive lab and involvement in projects.

The aim of the course is to introduce fellows to various fields related to the geophysical methodologies and technological tools dedicated to the acquisition, processing and integration of different geophysical data sets collected to locate archaeological structures and to characterize the historical buildings. During the lessons many results obtained during specific application in urban and suburban area have been presented and discussed with the fellows.

Content:

1. definition of high-resolution methods for the knowledge of archaeological sites and the characterisation of the historical buildings;
2. the development of specific acquisition techniques for the mapping techniques;
3. the definition of 2D and 3D geological model of the urban centres;
4. the acquisition, elaboration (modelling and inversion methods) and the representation techniques (2D-3D) for the high-resolution geophysical methods;
5. the evaluation of the geological hazards for archaeological sites in the environment and urban area.

Lessons made with the collaboration of Papale Enrico, Zamuner Daniela, Verrecchia Daniele of ITABC.

Chapter 6

Conclusions

The main goal of Diplomazia2 was to give the Trainees, a high level formation on the program's topics. It is worth noting that one of the reasons why candidates have applied within diplomazia2, was the hope to be trained in one of the most important European Research Institutions.

The Trainees have shown an average high commitment in the courses' attendance, and, in some cases, interesting scientific results have been achieved, as stressed in their reports.

In many cases, high-level scientific studies have been carried out during the training time and their results submitted to some papers and journals of international relevance. Some studies have also been presented in International Conferences.

Another Diplomazia2 important goal was to develop long-term collaborations between Italy (in particular CNR) and the Trainees' home-Countries. This goal was certainly obtained. Indeed, a number of scientific collaborations, as well as bilateral agreements, were established thanks to Diplomazia2. This is proved by the fact that trainees and their tutors, started addressing the preparation of bilateral projects and conventions aimed at encouraging scientific collaborations between CNR and its corresponding Institutions, already during the courses, as underlined in the reports.

The opportunity to build exchanges with other participants in the courses (i.e. from course 1 to 3; or from course 2 to 1) has represented an additional positive feedback.

In conclusion, Diplomazia2 can be defined "an useful tool to gain multidisciplinary knowledge, new skills and to create International Networks. It definitely helps strengthen intellectual and cultural bridges between countries that share the same unique resource: the Mediterranean Sea".

