



L-Università ta' Malta
Institute of Earth Systems

Institute of Earth Systems
2020/2021 Annual Report

Contents

1. Entity profile

Mission statement	3
Structure	
The Board of the Institute	4
The Division of Environmental Management and Planning	4
The Division of Rural Sciences and Food Systems	5
The Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD)	5
Staff developments	6
The year in review	6
The year ahead	7

2. Staff profile

Staff complement	8
Academic publications	9
Other relevant information	14

3. Learning and teaching programme profile

Programmes of study	17
Student information	20
Servicing of UM programmes	25
Servicing of external programmes	26

4. Achievements profile

Funded projects	27
International awards	29
International cooperation	29
Other activities and events	30

5. Governance profile

Institute Board meetings	34
Boards of Studies	34
Research Ethics Committee	35

6. Planning profile

Strategy/planning initiatives held during 2020/2021	36
Major strategic initiatives planned for 2021/2022	39

Appendix A: Student numbers on IES courses during 2020/2021	41
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1. Entity profile

Mission statement

The **Institute of Earth Systems** (IES) was set up with the primary aim of carrying out teaching and research in environmental and rural sciences, with a focus on Earth's complex and dynamic systems. It was established in May 2010 through a decision by the University of Malta Council to merge the former International Environment Institute (IEI) and the Institute of Agriculture (IoA) into a single entity.

The Institute adopts an Earth Systems approach which transcends traditional disciplinary investigation by adopting a wide and integrated perspective of the Earth's dynamic systems: the lithosphere, atmosphere, hydrosphere and biosphere. This approach includes the need for considering people and their activities within planning and management frameworks. The resulting focus on the synergies between science and policy-making is applied across all the Institute's teaching and research activities.

The IES offers taught and research-based programmes at diploma, undergraduate and postgraduate levels. We aim to provide our students with an enjoyable and stimulating learning experience, and to equip them with a problem-solving outlook which, combined with the scientific and management expertise acquired during their studies, is instrumental for success in their future lives and careers.

The Institute of Earth Systems also has a strong track record in international research and is able to draw on a wide network of research associates in the region and further afield.

Structure

The Institute is made up of two divisions, the **Division of Environmental Management and Planning** and the **Division of Rural Sciences and Food Systems**. Professor Godfrey Baldacchino served as Chairman of the Institute during 2020/2021, while Professor Louis F Cassar occupied the positions of Director of the Institute and Coordinator of the Division of Environmental Management and Planning, and Professor Everaldo Attard was Coordinator of the Division of Rural Sciences and Food Systems.

Also part of the Institute of Earth Systems are the **Euro-Mediterranean Centre on Insular Coastal Dynamics** (ICoD), and the **Mediterranean Operational Centre for CEDARE** (Centre for Environment and Development for the Arab Region and Europe).

The Institute is a founding partner of the **I-Land Observatory and Interpretation Centre – discover Earth Systems**, located in the Ta' I-Għasfura area of Mgarr. In collaboration with the HSBC Malta Foundation and the Mgarr Local Council, Malta's first centre for integrated natural and cultural heritage management was set up within the Kuncizzjoni ta' Calumia Barracks and Searchlight Emplacement. The Centre aims to provide a public space within the Maltese Islands for social-ecological purposes, to meet multiple objectives including nature conservation and ecological restoration, providing a recreational area for the general public and furthering education and interpretation relating to Maltese heritage.

The Board of the Institute

According to its statute, the Institute of Earth Systems is governed by a Board which holds quarterly meetings to discuss the Institute's affairs, to formulate its policy, and to supervise its activities and administration.

Chairperson

Professor Godfrey Baldacchino

Deputy-Chairperson

Director of the Institute

Coordinator of the Division of Environmental Management and Planning

Professor Louis-F Cassar

Coordinator of the Division of Rural Sciences and Food Systems

Professor Everaldo Attard

Head of the Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD)

Professor Anton S Micallef

Council appointee

Ms Joyce Farrugia

Senate appointee

Dr Ing. John Charles Betts (*till May 2021*)

Academic staff representatives

Dr Belinda Gambin - *Division of Environmental Planning and Management*

Dr Anthony Sacco - *Division of Rural Sciences and Food Systems*

Scholars of repute

Dr Leonie Baldacchino - *The Edward de Bono Institute for Creative Thinking and Innovation*

Professor Alex Felice - *Faculty of Medicine and Surgery*

Professor Paul J Pace - *Faculty of Education*

Professor Frank Ventura

Student representatives

Mr Jeremy Bartolo (*from December 2020*)

Mr Nathan Grech (*from December 2020*)

The Division of Environmental Management and Planning

The Division of Environmental Management and Planning is concerned primarily with the management of natural environmental resources, with a focus on integrated planning of the sustainable use of these resources. As well as interdisciplinary undergraduate and postgraduate courses, it also provides training for continuing professional development in the form of periodic short courses, seminars and workshops.

The Division's staff also participate actively in international research, drawing on a network of associates built up over the years and maintaining strong links with partner organisations across the Mediterranean and further afield.

Under the over-arching theme of sustainable development, the Division focuses on the following main subject areas:

- the science and management of earth systems
- environmental planning
- integrated resource management
- social-ecological systems
- biodiversity, conservation and protected area management
- environmental assessment and policy
- corporate environmental management
- climate, and weather processes and forecasting
- atmospheric pollution
- palynology and climate reconstruction
- coastal management
- hazards assessment and risk management
- landscape research, including landscape ecology and management, and environmental ethics.

The Division of Rural Sciences and Food Systems

The Division of Rural Sciences and Food Systems focuses on the agricultural sciences, and conducts and coordinates research relevant to the needs of modern Maltese agriculture.

The Division's remit also includes an input to the development of national agricultural plans, a consultancy service on the efficient use of local agricultural resources, and the pioneering of new and innovative agricultural technologies. It also fulfils a professional advisory role and provides extension services to the local farming community.

The Division's primary focus is on the following areas:

- management of rural land resources
- rural development
- agricultural products and food systems
- medicinal and aromatic plants
- agro-ecosystems, including crop management and health
- soil and water management
- rural policy and legislation, and
- landscape architecture.

The Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD)

The Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD) forms part of a network of specialised centres operating under the aegis of the EUR-OPA Major Hazards Agreement

of the Council of Europe. EUR-OPA is a platform for cooperation between European and Southern Mediterranean countries in the field of major natural and technological disasters.

ICoD was established in 1988 at the Foundation for International Studies, and since becoming part of the Institute of Earth Systems in 2008, it has actively participated in the Institute's programme of capacity building and research activities. The Centre's focus is on training and research on the marine and coastal environment, with a particular interest in coastal hazards and in the interactive processes which occur within the coastal zone and insular areas.

Staff developments

There were several changes among the Institute's administrative staff during 2020/2021. Ms Sharon Anne Sciberras Drago, Administration Specialist, left on maternity leave in December 2020. Ms Medea Lajtar, joined the Institute in January 2021 as Administrator I, and Mr Andrew Cassar joined the Rural Sciences and Food Systems Division as Senior Laboratory Officer in February 2021.

Ms Rosette Zarb (General Administrator) reached retirement age in February 2021 and, after an extension to her contract, left University employ at the end of September 2021.

Amongst the academic staff, Dr Charles Galdies was promoted to Assistant Professor in February 2021, while Professor Anton Micallef was on sabbatical leave for the second consecutive year between October 2020 and September 2021.

The year in review

This report presents a detailed overview of the activities and achievements of the Institute of Earth Systems during the academic year 2020/2021. The Institute continued to offer its three undergraduate programmes during this period, namely the Diploma in Agriculture, the B.Sc. (Hons) in Earth Systems and the B.Sc. (Hons) in Agro-ecosystems Management. Two Master-level-programmes in areas corresponding to the main areas of focus of the two Divisions were also offered – these were the intensive full-time M.Sc. in Natural and Environmental Resources Management, and the M.Sc. in Rural and Environmental Sciences, which is a research degree offering more flexibility through allowing students the option to enrol on either a full- or part-time basis.

Between October 2020 and September 2021, a total of 45 students graduated across the Institute's various programmes. Teaching and assessment methods during this period were modified so that all the required safety protocols relating to COVID-19 could be followed while minimising the disruptive effects on our students.

Research continued to form a crucial part of the Institute's mission, and members of staff both led and contributed to a number of local and international research initiatives in their areas of specialisation, resulting in over 50 academic publications during the years 2020 and 2021. In recognition of the importance of outreach, marketing and student recruitment also continued to be actively prioritised, with the Institute maintaining a strong online presence through its website and social media pages.

The year ahead

The Institute of Earth Systems is committed to ensuring excellence in the performance of its mission in terms of both teaching and research in the subject areas of the rural and environmental sciences. Towards this end, the potential accreditation of the B.Sc. (Hons) in Earth Systems by the Institute of Environmental Management and Assessment (IEMA), the largest professional body for environmental practitioners worldwide, will continue to be explored during 2021/2022. Also worthy of note are the plans to relaunch the dual degree M.Sc. programme which has been offered jointly with James Madison University in the US in various forms since 2009. The course is being modified in order to impart a more tangible “dual-degree” experience, with all students spending a semester each in Malta and in the US, and enrolment of the first students on this new programme is expected to start in 2023.

Changes in the staff at the helm of the Institute itself, as well as its component Divisions and the Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD), are expected within the near future. Professor Louis-F Cassar will be taking a two-year sabbatical between October 2022 and September 2024, necessitating the appointment of a new Director for the Institute as well as a new Head of the Environmental Management and Planning Division. The appointment of a new Head of ICoD will also be necessary, following Professor Anton Micallef’s retirement at the end of the coming academic year.

2. Staff profile

Staff complement

Resident academics

Environmental Management and Planning Division

Professor Louis-F Cassar, *Division Coordinator*

Dr Elisabeth Conrad

Professor Charles Galdies

Dr Belinda Gambin

Professor Anton Micallef, *Head, Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD) - on sabbatical during 2020/2021*

Dr Mark Scerri

Rural Sciences and Food Systems Division

Professor Everaldo Attard, *Division Coordinator*

Professor David Mifsud

Dr Anthony Sacco

Visiting academics

Environmental Management and Planning Division

Mr Mark Busuttil

Rural Sciences and Food Systems Division

Dr George Attard

Dr Mauro Buttigieg

Mr Larry Shoemake

Administrative and technical staff

Environmental Management and Planning Division

Ms Michelle Cassar - Senior Administrator

Ms Sharon Cross - Administrator II

Ms Medea Lajtar - Administrator I (*from January 2021*)

Ms Christa Marie Pisani - Technical Officer II

Ms Sharon Anne Sciberras Drago - Administration Specialist (*till December 2020*)

Rural Sciences and Food Systems Division

Mr Adrian Bugeja Douglas - Laboratory Officer

Mr Andrew Cassar - Senior Laboratory Officer (*from February 2021*)

Ms Rosette Zarb – General Administrator (*till September 2021*)

Academic publications

(Authors' names in **bold** indicate IES staff members)

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Other relevant information

During the academic year in review, the Institute's academic and administrative staff followed a number of internal UM training programmes, many of them aimed at facilitating the remote delivery of lectures made necessary by the prevailing Covid-19 pandemic. The training provided focused on the design and online delivery of study-units, online assessment of study-units through WISEflow, and the use of Google Meet for virtual meetings with students.

Memberships of Boards and Committees

UM commitments

Professor Louis-F Cassar

- Rector's Delegate to Gozo Campus (*till June 2021*)

Dr Elisabeth Conrad

- Member of the Board of Studies of the Masters in Environmental Ethics, Faculty of Theology
- Member of the University Research Ethics Committee (UREC)

Dr Belinda Gambin

- Member of the SEA-EU ("The European University of the Seas") UM Mobility Subcommittee

Professor David Mifsud

- Director of the Centre for Liberal Arts and Sciences (CLAS)
- Council Member representing academic staff

Other roles

Professor Everaldo Attard

- Maltese delegate within the Herbal Medicinal Products Committee (HMPC). Due to Covid-19, meetings were held virtually in November 2020, and in March, May and July during 2021.

Professor Louis-F Cassar

- Review Editor for the chapters on Biodiversity and Biodiversity Policy, within the United Nations Environment Programme (UNEP) team engaged in the preparation of the Global Environmental Outlook - GEO-6.

Dr Elisabeth Conrad

- External expert for the European Commission, providing evaluation, monitoring and advice regarding Horizon Europe project proposals and project progress. Also acted as ethics evaluator for same body.

Dr Belinda Gambin

- Board member on the National Scientific Advisory Council for the Environment (SACE) within the Ministry for Sustainable Development, Environment and Climate Change.

Professor David Mifsud

- Editor of the scientific journal Bulletin of the Entomological Society of Malta
- Associate Editor for Life Sciences for the scientific journal Xjenza Online, published by the Malta Chamber of Scientists.
- Member of the Editorial Advisory Board of the scientific journal BIOTA
- Consultant biologist with Capital Pest Control (CPC), and provided expertise in pest control at Farsons Ltd., Sunshine Snacks, Golden Harvest, and Magro Brothers Ltd.
- Member of the Plant Protection Board, the national plant protection organisation tasked with reviewing the state of plant quarantine in Malta, policy formulation and provision of advice regarding particular pests and diseases.

Dr Mark Scerri

- Appointed to contribute the air quality section of the State of the Environment Report 2022. This work involves the analysis and interpretation of national trends in atmospheric levels of the main pollutants for the period 2016 to 2020.
- Provided advisory services to the Environment and Resources Agency (ERA) in the area of air monitoring, analysis and modelling, thus assisting ERA to develop an air quality plan for the Maltese Islands.

Participation in Conferences, Seminars and other events

November 2020

Professor Everaldo Attard attended the IUPHAR Mediterranean Group of Natural Products Pharmacology (IMGNPP) First Meeting (virtual). The IMGNPP works towards the promotion and growth of scientific knowledge on products of natural origin used in the health field.

February 2021

Professor Everaldo Attard participated in the international online panel event on Fruit and Vegetable Genetic Diversity: The Status and Challenges of Conservation, Exchange and Use, organised by the FAO's Secretariat of the International Treaty, in collaboration with the Global Crop Diversity Trust. The event provided a global overview of the status of fruit and vegetable genetic resources, and presented experiences and challenges in the conservation, sharing and use of genetic resources of horticultural crops and fruit trees. It also highlighted the importance of the genetic diversity of fruits and vegetables for food and nutrition security.

Professor Charles Galdies was a keynote speaker at the Annual Meeting of the Mediterranean Regional Information Network (MedRIN), held virtually in February 2021. MedRIN is the regional arm of the Global Observations of Forest Cover and Land Use Dynamics (GOFC-GOLD) supported by both NASA and JRC. Professor Galdies spoke on the use of Earth Observation for land cover change dynamics in Malta and related future opportunities for scientific collaboration with both MEDRIN and the ERATOSTHENES Centre of Excellence (ECoE). Particular topics included soil erosion studies, sustainability of historical buildings and the move towards increased resilience to climate change

In his capacity as Head of ICoD, **Professor Anton Micallef** participated in the Council of Europe Forum on Disasters, Displacement and Climate Change titled "Can Democracy Save the Environment?" at the 9th World Forum for Democracy in February 2021. Professor Micallef

delivered a presentation on climate change impacts on coastal dynamics, with specific reference to natural coastal hazards.

March 2021

Dr Elisabeth Conrad served as panellist during a discussion event exploring the psychological effects of nature and the environment on people's minds, organised by the Malta branch of the European Geography Association (EGEA) as part of their Healthy Space Healthy Mind – An Environmental Campaign" event.

Professor Everaldo Attard participated online in the first trans-European seminar on science-based policy advice in agriculture, food, climate and environment, jointly organised by the Danish Centre for Food and Agriculture (DCA) and Danish Centre for Environment and Energy (DCE) at Aarhus University, together with the European Science Advisors Forum (ESAF). The objective of the seminar was to facilitate exchange of information, experiences and challenges, and to provide inspiration for the future development of best practices with the aim of strengthening evidence-based policy formulation across Europe.

May 2021

Dr Mark Scerri delivered a presentation at the use workshop of the International Network to Encourage the Use of Monitoring and Forecasting Dust Products (inDust) COST (Action CA16202) on research in Malta on the effect of Saharan dust events on air quality.

July 2021

Professor Everaldo Attard delivered a presentation titled "Good Manufacturing Practice (GMP), as applicable to medicinal cannabis" at the Award in Good Manufacturing Practice event held at the Malta Life Sciences Park in San Ġwann and organised by the Academy for Patient Centred Excellence and Innovation in Regulatory Sciences and the Malta Medicines Authority.

3. Learning and teaching programme profile

Programmes of study

The following programmes of study were delivered by the Institute of Earth Systems during the academic year 2020/2021.

Undergraduate Courses

Diploma in Agriculture

Coordinator: Dr Anthony Sacco

The Diploma course is a one-year day course that provides an introduction to agricultural sciences. During the first semester, all students follow all study units and an optional study unit on either crop production or animal science. During the second semester, students choose a specialization area from among animal science, crop science and herb science; they also follow a study unit on food systems, and are required to prepare a report on a topic which is chosen and agreed upon earlier during the year.

Bachelor of Science (Honours) in Earth Systems

Coordinator: Dr Belinda Gambin

External Examiner: Dr Kate Parks, Senior Teaching Fellow in GIS within Geography and Environmental Science at the University of Southampton, UK

The **B.Sc. (Hons) in Earth Systems** is a three-year full-time degree that transcends disciplinary boundaries and adopts an integrated and holistic approach to the study of the Earth. It considers the various components that make up the earth system within the broad context of environmental, social, economic and cultural sustainability. The emphasis is on developing an interdisciplinary and practice-oriented outlook. The programme differs from traditional Earth Sciences degrees in that Earth Systems Science is a science-based but policy-oriented field.

The programme of study employs a variety of teaching methods, including lectures, laboratory and field-based practical sessions, residential field trips (both locally and overseas), seminars, and supervised independent research.

Notable events during 2020/2021 included a week-long training session in Iceland on field survey techniques for the life and earth sciences in September 2021, and the third edition of the Earth Systems Graduate Launchpad in July, which highlighted recent research projects carried out by students reading for this degree programme. Further details about these activities can be found in section 4 of this report.

Bachelor of Science (Honours) in Mediterranean Agro-ecosystems Management

Coordinator: Prof. Everaldo Attard

The **B.Sc. (Hons) in Mediterranean Agro-Ecosystems Management** is a three-year full-time day course with a total of 180 ECTS credits. The course covers a number of different areas ranging from the basic rural sciences (cell biology, biochemistry, chemistry, soil, water, microbiology and genetics) to more applied rural sciences (farm animals, crops, biotechnology, herb science, aquaculture and food systems). Other aspects include analytical skills in measurement (physics, mathematics, modelling and data-mining/management/processing), Mediterranean agro-ecosystems resource management, and policy and regulation (economics, marketing, policies, legislation and environmental stewardship).

This course equips graduates with a multidisciplinary scientific foundation and with the appropriate professional knowledge required to manage and consult on the technical and economic aspects relating to the management of Mediterranean agro-ecosystems.

Postgraduate Courses

Master of Science in Natural and Environmental Resources Management

Coordinator: Prof. Charles Galdies

External Examiner: Dr Kate Parks, Senior Teaching Fellow in GIS within Geography and Environmental Science at the University of Southampton, UK.

The **M.Sc. in Natural Environment and Resources Management** was launched in October 2018, and is an intensive one-year taught programme designed to provide students with the opportunity to work on the sustainability challenges of our time. The programme of study consists of four components: core material, methodology, specialization area and a dissertation, and the course content focuses on working towards finding solutions for societal problems related to natural resource exploitation and environmental change.

This degree programme aims to provide students with a strong postgraduate grounding in key concepts and current thinking relevant to Earth systems science and its application to policy and planning. It also provides an opportunity for in-depth focus in a thematic area relevant to environment and resource management in which the candidate has specific interest, including the possibility to travel to other countries to conduct primary research.

The three-semester programme of study comprises 90 ECTS credits, of which 60 ECTS form the taught component while the remaining 30 ECTS are research-based in the form of a dissertation.

Notable activities during 2020/2021 included a biodiversity conservation field trip to Tuscany, Italy in September 2021, during which students visited the coastal Parco Regionale della Maremma, the marine/coastal Parco dell'Arcipelago Toscano, and a UNESCO Geopark (Parco delle Colline Metallifere Grossetane), among others.

Master of Science in Rural and Environmental Sciences (by research)

Coordinator: Prof. Everaldo Attard

External Examiners:

- **Professor Matilde Tessitori**, Sezione Patologia Vegetale, Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), Università degli Studi di Catania
- **Professor Stefano La Malfa**, Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), Università degli Studi di Catania
- **Professor Cherubino Leonardi**, Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), Università degli Studi di Catania
- **Professor Eric Conti**, associate professor of Agricultural Entomology and Insect Biotechnology, University of Perugia, Italy
- **Professor Cesare Castellini**, Dipartimento di Scienze Agrarie, Alimentari ed Ambientali (DSA3), University of Perugia, Italy
- **Dr Aleksandar Uzunov**, Associate Professor, Institute of Animal Biotechnology, Faculty of Agricultural Sciences and Food, Ss. Cyril and Methodius University in Skopje, Macedonia

The **M.Sc. in Rural and Environmental Sciences** is research degree, offered on both a full-time and part-time basis, delivering 90 ECTS credits over a three-semester period. The programme takes an interdisciplinary approach to addressing current issues of concern relating to the two areas of study, based on the rationale that there are strong interlinkages between environmental, planning, rural, urban, and other social and economic concerns.

Learning outcomes thus include a solid understanding of key aspects of the complex issues with which professionals are often confronted. The course also fosters an awareness not only of the science of environmental and/or rural science concerns, but also of their ethical, sociological and economic dimensions. The training provided throughout the course enables students to critically address their area of research specialization in a holistic and integrated fashion. Students also gain experience in practical applications through hands-on projects, and have the opportunity to focus on an area of particular interest to them through directed study units and through their dissertation research.

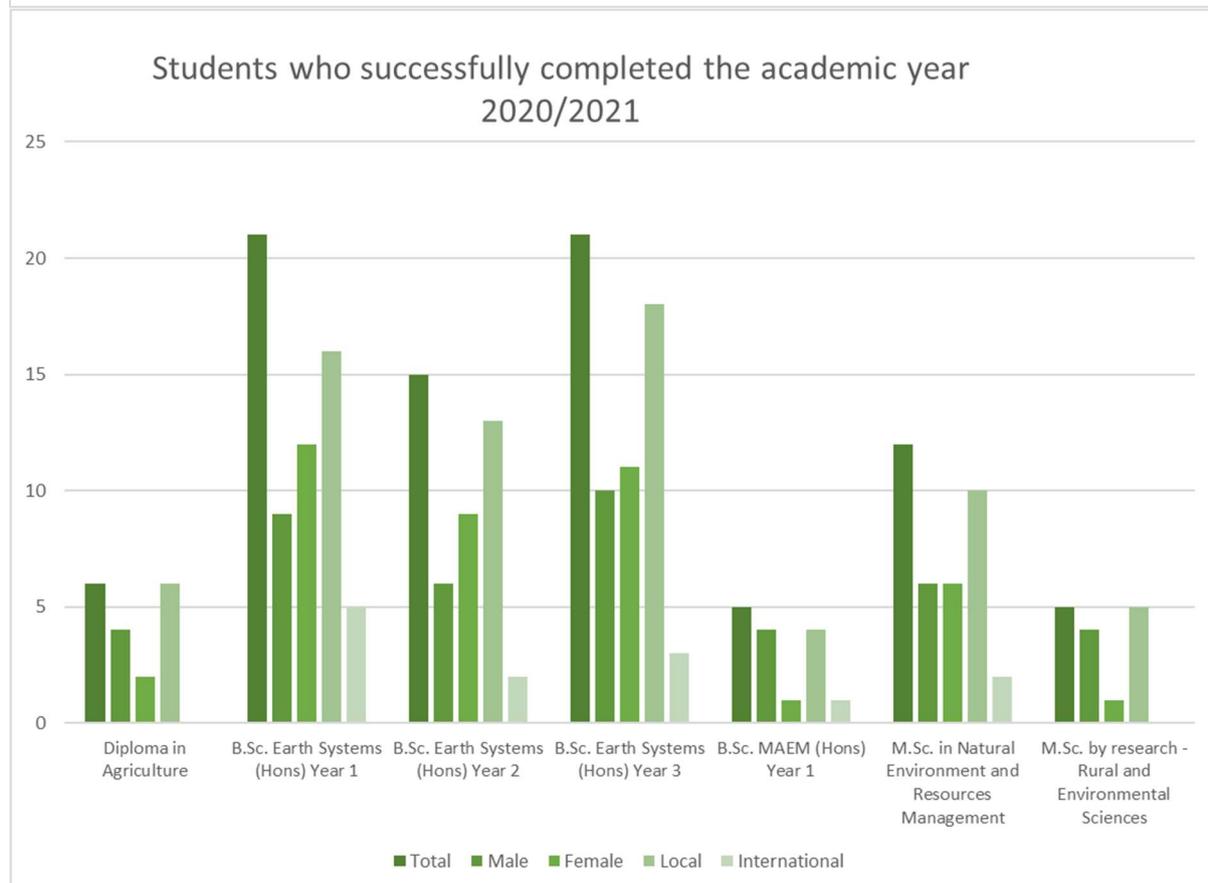
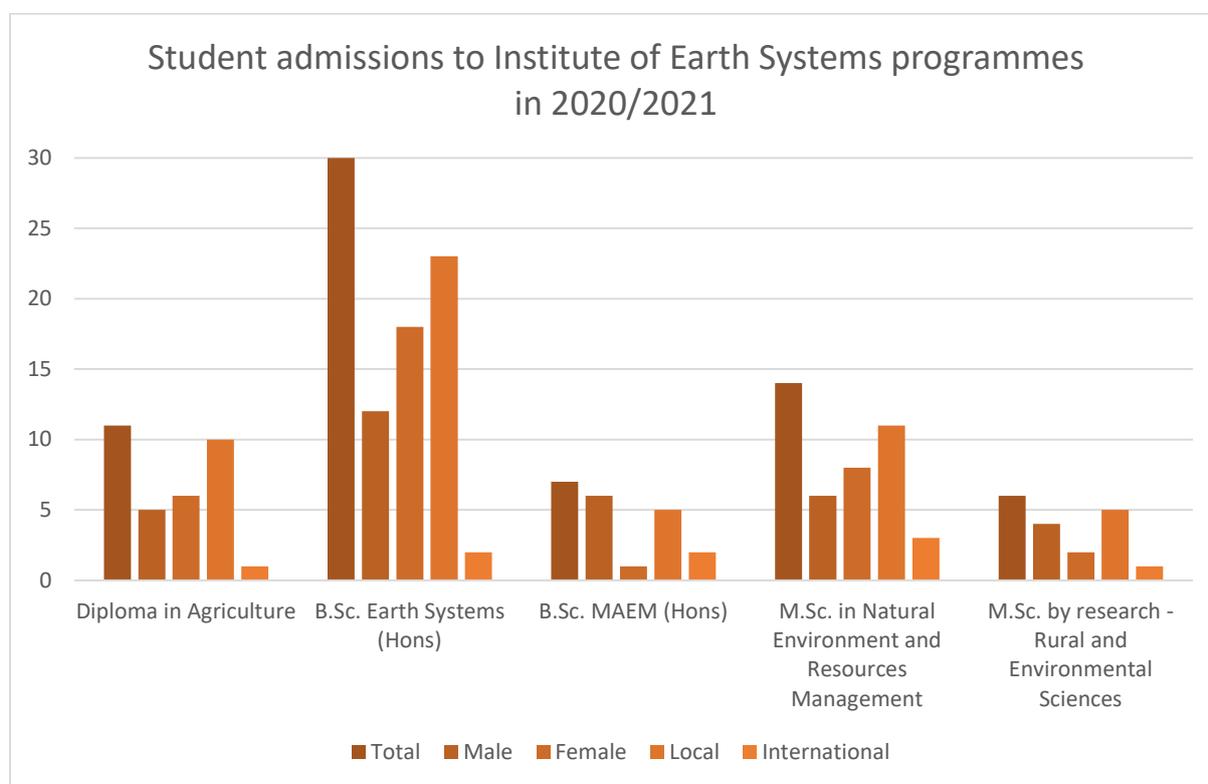
M.Phil. and Ph.D.

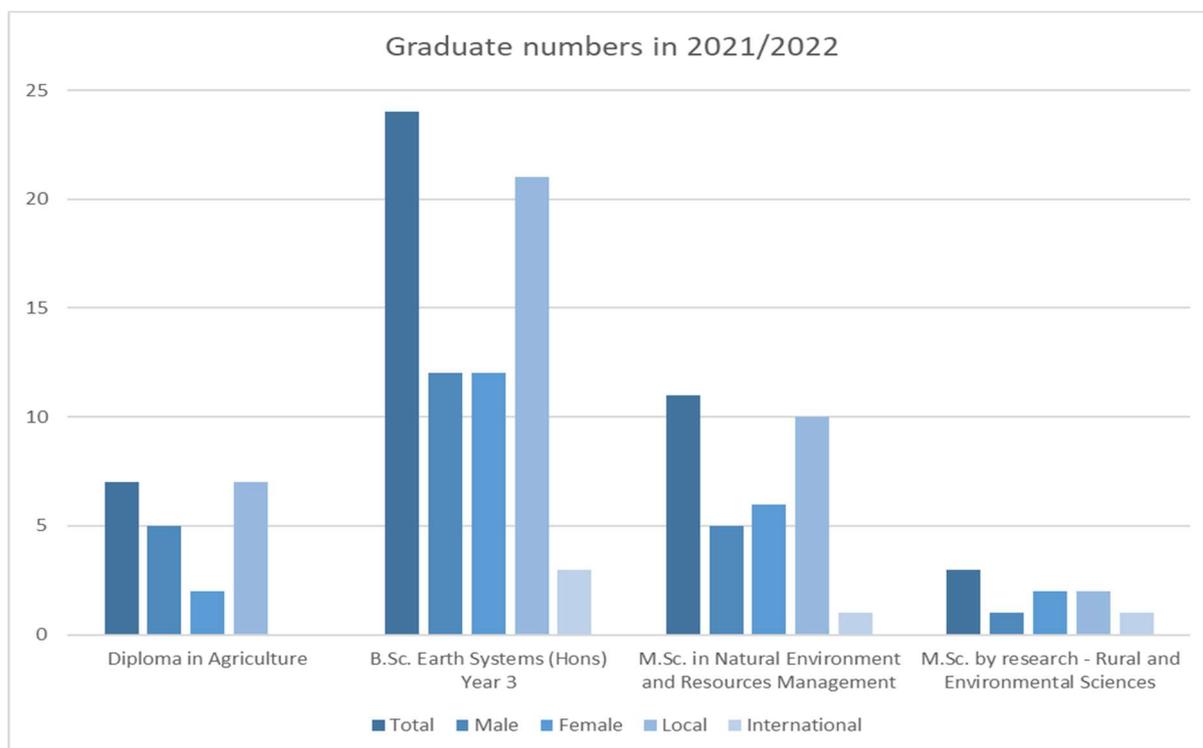
The Institute invites prospective students wishing to read for a Ph.D. to explore the academic staff's fields of interest and expertise (available online) and to make contact in order to discuss their research proposal.

Full details regarding all the Institute's courses are available online at <http://um.edu.mt/ies>

Student information

Student numbers





N.B. Full details of student numbers on each programme can be found in Appendix A.

Diploma in Agriculture

Eleven students were admitted in October 2020, of whom six students finished the year and graduated in December 2021. An additional student from the 2019 cohort also graduated in December 2021.

Bachelor of Science (Honours) in Earth Systems

Thirty students were admitted in October 2020, of whom 21 students successfully completed the first year.

During this academic year, one student (male) qualified for a Higher Diploma in Earth Systems, while another two students (both female) qualified for a Diploma in Earth Systems. All three of these students graduated in late 2021.

A total of twenty-four students graduated with a B.Sc. (Hons) in Earth Systems in December 2021.

Two B.Sc. (Hons) in Earth Systems students participated in the Erasmus+ Programme during the academic year 2020/2021. One student spent a semester at Bournemouth University in the UK, while another student undertook an Erasmus+ Traineeship at the Archipelagos Institute of Marine Conservation in Greece immediately following her graduation.

Twelve French Erasmus+ students, of whom six were male and six female) also enrolled in a number of study-units within the above B.Sc. programme during the first semester of 2020/2021.

Bachelor of Science (Honours) in Mediterranean Agro-ecosystems Management

Seven students were admitted to the first year of this programme in October 2020, of whom five successfully finished the year.

Master of Science in Natural and Environmental Resources Management

Twelve students enrolled in this course in October 2020, of whom seven students selected environmental pollution as their elective stream while the other five opted for the biodiversity conservation stream.

Six students graduated with an M.Sc. in Natural and Environmental Resources Management in October 2021, and a further five students, who had been granted an extension of studies, graduated in March 2022.

Master of Science in Rural and Environmental Sciences (by research)

Six students were admitted to the programme in February 2021, while three students from previous years' intakes graduated with an M.Sc. in Rural and Environmental Sciences in March 2022.

M.Phil. and Ph.D.

During 2020/2021, the following three students were registered with the Doctoral school:

Mr Adrian Bugeja Douglas (2014/5 intake)

Supervisor: Professor Luigi Russi

Thesis title: Molecular Characterisation of Maltese Honey

Status: Ph.D. student

Mr Godwin Degabriele (2015/2016 intake)

Supervisor: Professor David Mifsud

Thesis title: The thrips (Hexapoda, Thysanoptera) of the Maltese Islands

Status: Ph.D. student

Ms Desiree Falzon (2019/2020 intake)

Supervisor: Dr Elisabeth Conrad

Thesis title: Connecting children with nature in urban, spatially-challenged school grounds: towards the design of nature-based spaces for learning across the curriculum in primary school grounds

Status: M.Phil. student, upgrade report to be submitted within the next academic year

Student projects, dissertations and theses

Diploma in Agriculture

Brincat, A-D A Land Evaluation Report for a Rainfed & Irrigated Agricultural Land in Girgenti Area

Caruana Finkel, A The Viability of Community Supported Agriculture in Malta

Grima, P An Overview of Afforestation Projects in Malta and a Discussion on What the Country Could Do to Up Its Game and Increase Forested Spaces

Magro, I Grafting Different Types of Trees: Stone Fruit, Citrus and Vines

Bachelor of Science (Honours) in Earth Systems

Aguis, G Monitoring of VOCs in vehicle enhancement facilities through the use of VOC diffusion tubes

Bartolo, J Verification of ERA's "Third Round - Major Roads Noise Map" for Mellieha for Triq Louis Wettinger and Comparison to Triq Gorg Borg Olivier

Borg Brincat, AV Consumer Attitude and Perception towards Sustainable Fashion Practices on the Maltese Islands

Cini, T An Analysis of Hardstone Quarrying from a Blast Monitoring Perspective

Cremona, MC Construction of a Typical Meteorological Year for Air Temperature

Cutajar, C Further Development to the Integrated Coastal Map for the Maltese Islands

De Rossi, Z Using permaculture principles to design a public garden in Iklin, Malta

Galea, Y A Management Framework for Tal-Wej

Gauci, E The Life Cycle of the Strawberry Fruit; A Physicochemical Perspective

Ghirxi, D Investigating Willingness to Downsize in the Maltese Islands

Krnacs, KL Assessment of Environmental Conditions of Fungal Species: A Case Study of a Museum

Laudi, L Maltese Honey as a Bioindicator of Atmospheric Heavy Metal Pollution in Malta

Micallef, GL Revival of the Bidni Olive Tree: A Ten-Year Review

Mifsud, E A Management Framework for Quarry Rehabilitation: A Case-study

Mizzi, F A Policy Brief for Community Gardens in Malta

Psaila, J An Investigation into Cyclo-Commuters' Exposure to Particulate Matter on Maltese Roads

Piscopo, M Investigating how Soil pH and Other Soil properties Affect the Wine Grape Quality

Saliba, D Assessing Sustainable Measures on a University Campus: Focusing on Energy

Sciberras, G Heavy Metal Concentrations in Road Side Soil and the Correlation with Traffic in Malta

Spiteri, S Spatial and temporal air quality analysis of the Maltese Islands, in relation to the COVID-19 partial lockdown

Zammit, A Quantifying the extent of surface water runoff around the Maltese Islands using remote sensing

Zammit, R A Meteorological and Statistical Analysis of Local Convective Storms

Master of Science in Natural and Environmental Resources Management

Azzopardi, P The Influence of Light Intensity on the Nocturnal Movement of Avifauna

Clark, Y Identifying Landscape Quality Objectives for the Maltese Islands

Grech, N Investigating Ecological Corridors and Barriers to Movement: A Species Approach for Conservation

Puglisevich, E

Management of Xeric Grasslands to Improve Connectivity for Stenotopic Biota

Piscopo, A

Assessing the Air Quality Derived from Marine Traffic in the Central Mediterranean and Malta

Master of Science in Rural and Environmental Sciences (by research)

Albanazzo, M The Status of *Vespa orientalis* in Malta - A preliminary study

Cassar, A The Fate of Lycopene and Other Carotenoids from Feed to Egg in Two Laying Hen Set-ups

Fajak Hanan, Z Valorization of the Local Fig Tree: A Morphometric and Physicochemical Study

Sammut, I Morphological and Physicochemical Analysis of Local Varieties of Prickly Pears (*Opuntia ficus-indica* (L.) Mill.) from Malta

Sciberras, A Cultivation of Goji Berries (*Lycium barbarum* and *Lycium ruthenicum*) in the Maltese Islands: An Analysis of the Main Minerals and Nutrients Found in Fresh Berries

Theuma, M Temporal Analysis of Ampelographic and Physicochemical Characteristics of the Maltese Grapevine Variety Girgentina

Xuereb, D Emerging Plant Health Risks: A Study of the Risk of Entry, Establishment and Spread of *Xylella fastidiosa* spp. (Well et al., 1987) in the Maltese Territory

Student Awards and other achievements

In July 2021, B.Sc. (Hons) in Earth Systems student Mr Luca Laudi was presented with the **Award for Academic Excellence** for the 2020/2021 academic year. Mr Laudi obtained consistently high results, including a minimum of 80 ECTS at grade A or better, and a further 20 ECTS at grade B or better, during the first two years of the course. In a ceremony held on 21 July 2021, the Institute's Director, Professor Louis F Cassar, presented the award certificate and vouchers to Mr Laudi. This award is presented annually and is sponsored by the HSBC (Malta) Foundation.

Following his graduation, Mr Laudi joined the Seismic Monitoring and Research Group (SMRG) at the University of Malta. This research group maintains the Malta Seismic Network, which is the only facility in Malta that monitors earthquake activity around the Maltese Islands.

Another of the Institute's recent B.Sc. graduates in Earth Systems, Ms Nadya Buga, published a paper in late 2021 titled "Evaluating drivers and barriers to adopting a local energy policy under the Covenant of Mayors Initiative in the small island state of Malta". This paper was based on Ms Buga's undergraduate dissertation and was published in the prestigious journal *Energy Policy*.

Buga, N & Yousif, C 2021, Evaluating drivers and barriers to adopting a local energy policy under The Covenant of Mayors Initiative in the Small Island State of Malta. *Energy Policy*, 159, 112586.

Another prestigious paper was published in the journal *Sustainability* by recent M.Sc. graduate Maria-Stella Portelli. The paper was co-authored by Dr Elisabeth Conrad and Professor Charles Galdies, and is based on Ms Portelli's research for her dissertation as part of the Institute's M.Sc. in Natural and Environmental Resource Management, in which she conducted a feasibility study for an environmental justice index for the Maltese Islands.

Portelli, M S, Conrad, E & Galdies, C 2020, Developing an environmental justice index for small island states: the case of Malta. *Sustainability*, 12 (22), 9519.

Servicing of UM programmes

The following is a list of additional study-units delivered or contributed to by academic staff members of the Institute of Earth Systems.

Undergraduate programmes

- B.Sc. (Hons) in Biology and B.Sc. (Hons) in Science for Education and Communication, **BIO3520 - Natural History of the Maltese Islands**, lectures on climatology of the Maltese Islands. *Professor Charles Galdies*.
- B.Sc. (Hons) in Pharmaceutical Sciences, **PHR3208 – Pharmacognosy and Natural Products**, lectures on chemistry and pharmacology of aromatic and medicinal plants. *Professor Everaldo Attard*.

- Geosciences (Joint Area) and B.Sc. (Hons) in Science for Education and Communication, **GSC1402 - Earth Observations from Space**, lectures on Earth observations from space. *Professor Charles Galdies*.
- LL.B. (Hons), **ERL4000 - Climate Change and International Law**, lectures introducing the science of climate change. *Professor Charles Galdies*
- B.Sc. (Hons) in Science for Education and Communication, **MSS2011 - Forensic Science**, laboratory sessions in relation to forensic palynology. *Dr Belinda Gambin*.
- B.Sc. (Hons) in Biology and B.Sc. (Hons) in Science for Education and Communication with specialisation in Biology, **BIO3022 – Parasitology**. *Professor David Mifsud*.
- Centre for Liberal Arts and Sciences, **LAS1010 - Beekeeping and the Art of Honey Making**. *Professor David Mifsud*.
- Centre for Liberal Arts and Sciences, **LAS1020 - Gardens at Risk: Fighting Plant Pests and Diseases**. *Professor David Mifsud*.
- Centre for Liberal Arts and Sciences, **LAS1034 - Plants, Insects, Birds and Man**. *Professor David Mifsud*.
- Centre for Liberal Arts and Sciences, **LAS1067 – Microbes: Unseen life on Earth**. *Professor David Mifsud*.
- B.Sc. (Hons) in Biology, supervision of student dissertation titled “The endogean beetles (Coleoptera) of the Maltese Islands”. *Professor David Mifsud*.

Postgraduate programmes

- M.Sc. in Pharmaceutical and Regulatory Sciences, **PHR5030 - Qualified Person Requirements: Pharmacognosy**. Entire unit delivered twice, once per semester, during 2020/2021. Study-unit coordinated and delivered by *Professor Everaldo Attard*.
- IOI Training Programme on Regional Ocean Governance for the Mediterranean, Black, Baltic & Caspian Seas, **GSC5101 - Global Ocean Governance Framework and Managing our Relations with the Oceans**, lectures on GIS, remote sensing and climatology for ocean science. *Professor Charles Galdies*.
- M.Sc. in Sustainable Energy, **MEC5009 - Energy and the Environment 2**, lectures on meteorology/climatology and renewable energy resources. *Professor Charles Galdies*.
- M.A. in Mediterranean Studies, **ATS5510 - Technology and Mediterranean Societies**, one 2-hour lecture. *Dr Belinda Gambin*.

Doctoral level

- Doctoral School, **DOC6026 - Getting Published: The Conference Paper**, 2 workshops a year. *Dr Belinda Gambin*.

Servicing of external programmes

- M.Sc. in Sustainable Heritage, at UCL Centre for Sustainable Heritage, University of London, lectures in **Integrated Pest Management (IPM)**. *Professor David Mifsud*.
- Regular talks and field work to members of the Entomological Society of Malta (ESM) and the Association of Maltese Apiculturists (AMA), focused mainly on insect-plant interactions, beekeeping and honey making. *Professor David Mifsud*.

4. Achievements profile

Funded projects

BeSafeNet - Protect yourself from hazards

A Council of Europe EUR-OPA Major Hazards Agreement project, coordinated by the European Centre on Disaster Awareness in Cyprus, with the participation of the Institute of Earth Systems' Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD). ICoD's role, coordinated by Professor Anton Micallef, involved membership of the BeSafeNet Editorial Board, dissemination of the BeSafeNet Olympiad competition, re-writing BeSafeNet web content to include additional new information, evaluation of Olympiad Essays, and preparation of multiple-choice questions on tsunamis and sea-level rise for the Olympiad.

Coastal Risk Assessment and Mapping

A Council of Europe EUR-OPA Major Hazards Agreement project, in collaboration with the University of Caen in Normandy (CERG centre) and the University of Modena and Reggio Emilia, Italy. ICoD's input was coordinated by Professor Anton Micallef and consisted of field data collection related to coastal risk assessment and mapping of selected coastlines in Gozo, Malta, and the production of risk maps related to coastal hazards for these areas.

Developing proposals to reflect in the modern constitutions the human & civic rights for secured safe life activities and protection of life, health & property against emergencies

A Council of Europe EUR-OPA Major Hazards Agreement project, coordinated by the Educational Centre for Major Risk Management (ECRM) in Armenia. The role of ICoD, under the coordination of Professor Anton Micallef, included analysis of the Maltese Constitution in relation to the above human and civic rights, in order to identify amendments that could be proposed in order to ensure such rights.

EO4HBCS - Earth Observation for Historic Building Conservation and Sustainability

Research project funded by the Malta Council for Science and Technology's Space Research Fund, jointly coordinated by Professor Charles Galdies and the Department of Conservation and Built Heritage's Professor JoAnne Cassar. The project aims to study the behaviour of traditional unmodified roofs (built of limestone slabs on arches or beams, and with a lime-based water-proof coating), traditional modified roofs (with insulation, membranes, etc.), and modern roofs in Malta, using the research as a test-bed for what happens in the wider Mediterranean.

FAST - Fight Alien Species Transborder

Thirty-month research project launched in April 2021 and funded under the EU's Interreg Italia-Malta Programme. The project is led by the Università degli Studi di Catania - Dipartimento di Scienze Biologiche, Geologiche ed Ambientali, with Professor David Mifsud as coordinator for UM. Its main aim is to combat the introduction, naturalization and spread of alien invasive species (AIS) and of harmful plant pathogens that threaten indigenous plants

and biodiversity, at sites having terrestrial and aquatic environments with a high cross-border character.

FAST activities during 2020/2021 included the virtual launch of the project in April 2021 and an online conference in June 2021 led by Professor Giovanni Onore, Professor of Entomology at the Catholic University of Quito in Ecuador, titled 'Alien Species: Bees, Einstein and Ecology', at which Professor Mifsud was one of the speakers.

L' olio di oliva nel Mediterraneo

Thirty-month research project (2019 – 2022) funded under the EU's LEADER programme within the Rural Development Programme for Malta, with the participation of Professor David Mifsud as scientific coordinator for Malta.

Project activities include carrying out DNA and molecular testing on the Maltese autochthonous varieties of olives dating back centuries, with the eventual aim of regenerating olive oil production derived from these varieties.

MEDIBEES - Monitoring of the Mediterranean Honeybee Subspecies and their Resilience to Climate Change for the Improvement of Sustainable Agro-Ecosystems

The MEDIBEES consortium, led by CIAPA of Spain and of which the University of Malta is a member, was awarded 1.74 million euros of funding by the EU PRIMA programme under Horizon 2020. This research project aims to generate new genetic information and markers that will be key to the selection of resilient honeybee breeds that are most resilient to climate change and common pathogens throughout the Mediterranean region. The Maltese team's work includes field studies on the native Maltese honeybee and mitochondrial tests of the genetic studies on all the honeybee subspecies investigated in the project.

UM participation is led by Dr Marion Zammit Mangion from the Department of Physiology and Biochemistry, while Dr Belinda Gambin is contributing expertise in melissopalynology and palynology, and the use of pollen traps.

NO PROBLEMS - Nourishing PRObiotics to Bees to Mitigate Stressors

This four-year research project (2018-2023) is funded by the EU's MSCA-RISE staff exchange programme, with the participation of Professor David Mifsud as project leader for Malta. The project aims to define a strategy based on the use of beneficial bacteria and plant extracts to combat the bee gut parasite *Nosema ceranae* and to evaluate the impact on bee health of the developed formulation.

PerMaVia - Malta Permaculture Viability Study

Two-year project funded by the European Agricultural Fund for Rural Development (EAFRD), with the participation of Dr Anthony Sacco and Professor David Mifsud. This project deals with the viability of permaculture in Malta via a study on the environmental conditions.

PLANTMETALS - Trace Metal Metabolism in Plants

This four-year European Cooperation in Science and Technology (COST) action on the metabolism of trace metals in plants commenced in October 2020. Professor Everaldo Attard is the Maltese coordinator, and is also a member of two working groups, one on pathways of trace metals from the soil and through the plant, and another on agronomic aspects of trace metal homeostasis: targeted fertilisation, agricultural management, and breeding.

Terrestrial Arthropoda of the Maltese Islands

This project has been ongoing since 2015 and is funded by a research grant from the University of Malta. The annual sum of €2,000 was provided in both 2019 and 2020.

TIP - Teach, Inspire and Protect!

This Erasmus+ research project was led by Birdlife Malta and aimed to teach and inspire educators to use contemporary teaching approaches connecting children with nature from their first years of kindergarten and school. Dr Elisabeth Conrad coordinated the following contributions by UM to the project:

- (i) a survey of the primary school teacher population to determine current use of outdoor spaces for teaching, and attitudes to/perceptions of a variety of aspects related to outdoor teaching;
- (ii) an evaluation of the physical school grounds of all primary schools in Malta to determine available outdoor space and extent of hard/soft landscaping.

With a total project budget in the region of €333,000, funding of €7,000 was provided for the carrying out of the above work during 2020/2021.

International awards

Professor Louis-F Cassar was the co-recipient of the Finalist and Winner Award in the category of Environmental Science by the Association of American Publishers Awards for Professional and Scholarly Excellence (PROSE Awards).

The 'PROSE Award' was conferred upon the United Nations Environment Programme (UNEP) team engaged in the preparation of the Global Environmental Outlook - GEO-6, of which Professor Cassar was Review Editor for the chapters on Biodiversity and Biodiversity Policy. UNEP's *Global Environment Outlook - GEO-6: Healthy Planet, Healthy People* is published by Cambridge University Press.

International cooperation

The first butterfly monitoring scheme for Malta was launched in November 2020 by the Institute of Earth Systems in collaboration with the National Museum of Natural History and Butterfly Conservation Europe, under the auspices of the ABLE project (Assessing Butterflies in Europe). The focal point for Malta is Professor Louis-F Cassar. A workshop was held, both online and in person at the Natural History Museum in Mdina, at which current monitoring schemes in Italy were presented, together with information on European policy and the ABLE project. The aim is to facilitate butterfly monitoring in the Maltese islands through the

projects' website and accompanying mobile app, and to promote citizen science. Data collected by volunteers will allow monitoring of trends in local butterfly populations, as well as comparisons of with other European countries.



The United Nations' 2030 Agenda for Sustainable Development contains 17 Sustainable Development Goals (SDGs) which cover the three dimensions of sustainable development, namely economic growth, social inclusion and environmental protection. In a total of 17 volumes, Springer's Encyclopedia of the UN Sustainable Development Goals comprehensively addresses these SDGs in an integrated way, and the 14th volume, addressing SDG 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development, features a work co-authored by Professor Charles Galdies.

This contribution addresses the topic of marine and coastal bio-resources, which play an essential role in human wellbeing and social and economic development. Written in collaboration with researchers from SINTEF Ocean in Trondheim, Norway and from the Faculty of Laws at the University of Copenhagen, it focuses on the problem of ocean acidification caused by rising levels of atmospheric carbon dioxide.



In July 2021, the University of Malta successfully launched a cooperation agreement with the Cyprus University of Technology with the aim of conducting earth observation research. Over the next five years, the Institute of Earth Systems and the Eratosthenes Centre of Excellence will cooperate on future projects of mutual interest, with a focus on the Mediterranean basin.

This cooperation agreement arose from the delivery by Professor Charles Galdies of a number of keynote addresses in a series of workshops, during which he presented details of earth observation activities in Malta related to natural resources management, conservation of urban environments, climate change impacts, weather forecasting and even public health, all of which can be adapted to the benefit of the Mediterranean region

Through this agreement, UM staff and students will benefit from faculty staff exchange opportunities, opportunities for student exchanges, participation in joint research projects, thesis co-supervision, and the exchange of measured data of common interest.

Other activities and events

Updates continued to be made during 2020/2021 to the new website launched in 2019; the site is found at <https://www.um.edu.mt/ies>. Throughout the year, the Institute's activities were regularly featured on Newspoint, the University's online news portal, as well as being included in the weekly Newspoint Update which is emailed to staff and students.

Newspoint articles published during 2020/2021 featured the various overseas field trips for students, the Earth Systems Graduate Launchpad event and Award for Academic Excellence, and the various-project-related activities that took place during this period.

Note-worthy Newspoint articles during 2020/2021 which are not covered elsewhere in this report include the following:

- **An expert's take on the code-red level status of climate change for humanity**
A two-part in-depth interview with Professor Charles Galdies in the wake of the 2021 Intergovernmental Panel on Climate Change (IPCC) report that the climate's global temperature is rising much sooner than anticipated.
- **Helping protect our bees**
A new short video, on the occasion of World Bee Day on 20 May 2021, highlighting the global importance of bees as pollinators, featuring Professor David Mifsud.
- **Tribute to Prof. Bruno Biavati**
Professor Biavati, who passed away in December 2020, was an Affiliate Professor at the Division of Rural Sciences and Food Systems within the Institute of Earth Systems. His area of specialisation was agricultural microbiology.
- **On the next ReTHINK Podcast: The Bold World of Bees**
A report by Professor David Mifsud on the progress of the on-going NO PROBLEMS project which aims to address the problem of declining honey bee populations through the use of probiotics to combat bee gut parasites.

The Institute also maintained active Facebook, Instagram and Twitter accounts which share details and photos of activities taking place throughout the year, and also regularly featured links to articles of topical interest related to the study of Earth Systems.

<https://www.facebook.com/um.earthsystems>

<https://www.instagram.com/umearthsystems/>

<https://twitter.com/uomies>

Online marketing and student recruitment for the various academic programmes offered by the Institute took place throughout the year, on Facebook, Instagram and Google Ads. Staff members also held numerous one-to-one online meetings with potential applicants to compensate for the lack of careers events at local post-secondary schools and colleges which were not held during 2021/2022 due to Covid-related restrictions.

The annual Careers Expo at Junior College, at which the Institute regularly participates and which was scheduled for April 2020, was unfortunately cancelled due to the prevailing Covid-19 situation, so an email drop to all students at Junior College, the Higher Secondary and a number of private sixth forms was carried out by the Coordinator of the B.Sc. (Hons) in Earth Systems. The text of this email included details of the special entry requirements for this degree programme and invited potential applicants to contact the Institute for more information.



The Institute considers feedback received from students to be essential in evaluating how its service provision is viewed by the most important group of stakeholders, namely its students. Besides providing students with an opportunity to comment on the quality of the teaching and learning environment at the University, feedback ensures that lecturers and Boards of Studies are made aware of problems perceived or encountered by students, and provides an opportunity for the conduct of self-evaluation and revision wherever necessary.

There are various channels for student feedback within the Institute: through direct informal comments to lecturers, via the VLE study-unit feedback forms, through the student

representatives at the level of the Institute Board and the Boards of Studies, and via the external examiners who usually interview all final year students. The above is in addition to the twice-yearly study-unit feedback survey and the feedback provided by students once they have completed the entire programme of study.

The Institute is also responsive to well-founded complaints on a case-by-case basis. Following a number of complaints by students, a special evaluation form for study unit EMP1018 - Introduction to Data Science: Python and SQL was handed out to first- and second-year students in order to obtain their detailed feedback. Changes made in response to the feedback received included the appointment of a new lecturer, and changes made to the timing of lectures and to the mode of assessment.



Two new study units were launched during the reporting period as part of the M.Sc. in Natural Environment and Resources Management (NERM) course, allowing students the choice of a new elective area of environmental pollution during their second semester. The new study units were **EMP 5020: Environmental Pollution - Policy and Planning** (5 ECTS) and **EMP 5021: Environmental Pollution - Theory and Application** (10 ECTS). Seven of the twelve M.Sc. students admitted in October 2020 opted for this new elective area.

A biodiversity conservation fieldtrip to Tuscany, Italy, led by Professor Louis-F Cassar, was held between 7 and 13 September 2021. The five participating M.Sc. NERM students, accompanied by staff from the Institute, visited the coastal Parco Regionale della Maremma, the marine/coastal Parco dell'Arcipelago Toscano, a UNESCO Geopark (Parco delle Colline Metallifere Grossetane), as well as a former protected area (Parco di Montioni) that has recently lost its protected status. Students were able to observe a range of conservation challenges, and to identify and assess the management issues being experienced and the strategies being employed in each particular context. Among the specific topics covered were the effects of climate change on protected areas, the need to find a balance between accommodating visitors and safeguarding sensitive habitats, and the concepts of wildlife corridors and ecological networks as mechanisms to protect regional biodiversity.



The third edition of the Earth Systems Graduate Launchpad was organised by the Institute of Earth Systems on 21 July, highlighting recent research projects carried out by students reading for the Institute's B. Sc. (Hons) in Earth Systems. The event was held at the Msida campus and was attended, both online on Zoom and in person, by students, members of the University's academic staff, and attendees from the government and private sector, as well as careers advisors from both sixth forms and secondary schools. Students presented eight of the highest-graded dissertations from the last two years, covering a wide range of issues of practical importance at both the local and regional levels.

The biennial B.Sc. (Hons) student field trip to Iceland, originally planned for the second semester, had to be postponed due to COVID-19 related travel restrictions, and finally took place between 25 September and 1 October 2021. The trip was organised with all necessary safety protocols in place, including mandatory testing of all participants within 72 hours of departure. Twenty-three undergraduates participated in this week-long training session in field survey techniques for the life and earth sciences. The students were accompanied by

members of the Institute's academic and technical staff, as well as by four of the Institute's M.Sc. students. The intensive programme of fieldwork focused on employing basic field surveying techniques to study several subject areas such as plant succession on lava fields, lichenometry, volcanology, and tephrochronology.



Professor Agnes Ricroch, from the Department of Life Sciences and Health, AgroParisTech, in Paris, gave a lecture on 10 December 2020 titled "Climate-smart agriculture and on the current applications of CRISPR-cas in agriculture". The lecture was attended by the students of the Institute's Rural Sciences and Food Systems Division. Professor Ricroch is Secretary of the Académie d'Agriculture de France, and is the author of six books on plant genetics, GMOs and plant biotechnology.



Volume 11 of the Bulletin of the Entomological Society of Malta, published annually since 2008 by the Entomological Society of Malta (ESM) and edited by Professor David Mifsud, was published in early 2021. The ESM's mission statement is to share experiences and knowledge, and to facilitate the study of insects and related organisms occurring in the natural environment of the Maltese Islands.

The Bulletin is an open access, peer-reviewed scientific journal with contents indexed in Biosis Previews, Biological Abstracts, Biosis Citation Index and Zoological Record, and its production is funded by an annual grant of €5,000 to €10,000 from various governmental and non-governmental entities and from industry.

This latest volume published in 2021 contains 26 peer-reviewed papers by 22 European authors. Almost all the papers deal with insects occurring in the natural habitats of the Maltese Islands and provide information about 130 different insect species found in Malta and Gozo, 54 of which were recorded for the very first time.

The ESM Bulletin has become the pre-eminent platform for publication of studies related to insects found in Malta. In the 11 volumes published so far, information has been made available on more than 1,900 insect species, including more than 550 new records for the Maltese Islands and three species which were new to science.

5. Governance profile

Institute Board meetings

The Board of the Institute of Earth Systems met on the following dates:

- Wednesday 16 December 2020
- Thursday 25 February 2021
- Thursday 27 May 2021

These meetings were held virtually via ZOOM due to the prevailing COVID-19 pandemic.

Boards of Studies

Diploma in Agriculture

Professor Everaldo Attard - *Chair*

Dr George Attard

Dr Mauro Buttigieg

Professor David Mifsud

Dr Anthony Sacco

Bachelor of Science (Honours) in Earth Systems

Professor Louis-F Cassar - *Chair*

Professor Godfrey Baldacchino

Dr Elisabeth Conrad

Dr Belinda Gambin

Mr Toni Tonchev - *Student Representative*

Ms An-Nikol Vrazhalska - *Student Representative*

Bachelor of Science (Honours) in Mediterranean Agro-Ecosystems Management

Professor Everaldo Attard - *Chair*

Dr George Attard

Dr Mauro Buttigieg

Professor Louis-F Cassar

Professor David Mifsud

Dr Anthony Sacco

Master of Science in Natural Environment and Resources Management

Professor Louis-F Cassar - *Chair*

Professor Godfrey Baldacchino

Dr Elisabeth Conrad

Dr Charles Galdies

Dr Belinda Gambin

Mr Nathan Grech - *Student Representative*

Master of Science (Rural and Environmental Sciences) by Research

Professor Everaldo Attard - *Chair*

Dr George Attard

Dr Mauro Buttigieg

Professor Louis-F Cassar

Professor David Mifsud

Dr Anthony Sacco

Research Ethics Committee

The Institute's ad hoc Research Ethics Committee ensures that the University's Research Code of Practice is adhered to. All research activity conducted by staff or students is subject to the University of Malta's Research Ethics Review Procedures which ensure that the highest standards of integrity and professionalism are observed in the conduct of research carried out under its auspices.

Chairperson

Rev. Professor Saviour Chircop

Members

Professor Joseph Cacciottolo

Professor Nadia Delicata – *from December 2020*

Dr Charles Galdies

Dr Anthony Sacco

Rather than meeting on fixed dates, the Institute's Research Ethics Committee meets remotely whenever needed in order to review research ethics applications. Applicants may therefore submit their completed URECA forms at any time of the year, and researchers within the Institute are encouraged to submit their URECA forms as soon as they have established their detailed methodology and prepared any data collection instruments they may require.

6. Planning profile

Strategy/planning initiatives held during 2020/2021

General

- The administrative offices of the two Divisions, which had previously functioned separately, were merged over the course of the reporting period, in view of the retirement of Ms Rosette Zarb who had previously handled the Rural Sciences and Food Systems administration for many years.
- Due to the Covid-19 situation, the Institute's administrative staff worked on campus on a roster basis between 8 March and 11 April 2021, as directed by the Rectorate.
- Other Covid-19-related adjustments included postponing lab sessions and fieldwork that had been scheduled to take place between 8 March and 11 April 2021. All lectures during this period were delivered online.
- The same Covid-19 protocol as the previous year for holding exams remotely was employed i.e., all written examinations were held online using the WISEflow platform. In addition, the mode of assessment of a number of study-units was changed to focus exclusively on assessments in response to the ongoing Covid-19 pandemic.
- The Institute continued to experience an acute shortage of office space during 2020/2021. The sub-basement level premises at Phoenix Court, offered to the Institute as project offices, failed a health and safety inspection due to air circulation problems and substandard bathrooms. The new designated building is not expected to be completed for another two years, and members of the Institute's staff were thus being housed temporarily at Dar id-Dur (belonging to the UM's Argotti Botanic Gardens & Resource Centre), at the Chemistry Building, and at the Rural Sciences Farmhouse. In addition, Dr Mark Scerri and Professor Anton Micallef were stationed in the portakabins in Car Park 3 after these were vacated during 2020/2021 by the Faculty of Science staff.
- The structural works being carried out during 2020/2021 due to excavation works close to the Rural Sciences Farmhouse included the demolition of two laboratories and rest rooms, the relocation of equipment and lab furniture, and the addition of two portakabins to increase lab space. Due to health and safety regulations, staff were advised during the first part of 2021 not to visit the building until further notice. Although two portakabins had been provided as temporary office space, conditions in these cabins were far from ideal due to the noise and vibrations from the ongoing works. Dismantled lab equipment started to be reinstalled in April 2021, but students were still having to use the laboratories on a roster basis (as a Covid-related measure to avoid overcrowding), and there was still a noise issue in the building due to continuing works on the Sustainable Living Complex just behind the Rural Sciences Farmhouse.

Courses

Diploma in Agriculture

- Work on restructuring the programme of studies of the Diploma in Agriculture course was continued during 2020/2021 by Dr Antoine Sacco, the Course Coordinator.

B.Sc. (Hons) in Earth Systems

- The Periodic Programme Review (PPR) of the B.Sc. (Hons) in Earth Systems was approved by Senate during its December 2020 meeting. It is worthy of note that the Institute of Earth Systems was among the first of the University's institutes to undertake this quality assessment exercise on its own initiative. The next Periodic Programme Review is due in 2025.
- As a result of the Periodic Programme Review (PPR), a number of changes were made to the final-year dissertation. It was decided that students would henceforth be given the option of completing either a research-based project (akin to a traditional dissertation), where there is an expectation that there will be generalisable knowledge produced, or a practice-oriented project, which is expected to produce outputs of practical relevance to professional needs or problems in the field. This change was intended to provide students with broader options, allowing the final-year project to better reflect both the diversity of student skills and strengths, as well as the variety of professional paths that students go on to follow after graduating. It was also decided to reduce the word count of the accompanying project report (from 15,000 to 8,000 words) so that students are able to better develop the skill of writing concisely, as expected in both academic and other professional circles. This change came into effect during the reporting period i.e., academic year 2020/2021.
- Other changes introduced during the reporting period included the introduction of a new exit award, the Higher Diploma in Earth Systems, to students who successfully complete study-units to which not less than 120 credits are assigned and, for whatever reason, do not complete the degree programme. This new exit award became available to students in April 2021.
- A further change arising from the 2020 Periodic Programme Review concerns the overall evaluation of a student's performance during the course and the classification of the degree awarded on graduation. Applicable to courses commencing in October 2021 onwards, the previously employed equal weighting of all three years' results is to be replaced with the following weightings:

First Year Average Mark	30%
Second Year Average Mark	35%
Third Year Average Mark	35%.
- The first-year fieldtrip to Sicily which had been postponed from 2020 was further postponed to the end of September 2021 due to pandemic-related travel difficulties.
- Due to the on-going COVID situation, the decision was taken, with Registrar's approval, for the overseas fieldwork unit EMP2009 to be offered as follows during 2020/2021: third year students took this unit during the second semester, while students currently in their second year deferred the unit to their third year, the exact timing to be determined at a later date. The field trip to Iceland for third-years

students finally took place between 25 September and 1 October 2021, and was organised with all necessary COVID-19 related protocols in place, including mandatory testing of all participants within the 72 hours before departure.

- In addition to marketing the Earth Systems B.Sc. course through Facebook, Instagram and Google Ads, an email drop to students at Junior College, the Higher Secondary and a number of private sixth forms was carried out early in 2021. The importance of reaching out to prospective students and perhaps providing them with a ‘taste’ of fieldwork, as well as the possibility of a video clip targeting secondary level students, was discussed at Institute Board level. It was also agreed that the possibility of collaborating with the Science Centre at Pembroke should be explored as a way of promoting the Institute’s courses, particularly through the Centre’s shadowing programme for secondary school students.

B.Sc. (Hons) in Mediterranean Agro-ecosystems Management

- The Division started to implement the recommendations of Professor Di Goia, the previous year’s external examiner for this degree course, in terms of an increase in the practical component of the programme, in collaboration with the Gozo Experimental Farm within the Ministry for Gozo, the Ministry of Agriculture, Fisheries and Animal Rights, and several private companies, including feed mills, beekeepers, the dairy industry, and olive mills.

M.Sc. in Natural and Environmental Resources Management

- A new elective area of environmental pollution was introduced for students admitted in October 2020 and later.
- During 2020/2021, the Board of Studies discussed at length whether the 20,000 word count for this programme’s dissertation was excessive, as well as the potential use of peer reviewed papers, and the possibility of reducing the number of written examinations within this degree programme. It was agreed that a Sub-Committee should be set up to further explore these issues and to establish with APQRU the viability of implementing changes. The option of replacing the dissertation with a literature review and a 7,000-word journal-style paper, aimed at encouraging students to submit their research for publication, was rejected by APQRU as not conforming to UM’s approach to Master level programmes, although it was noted that similar proposals had been submitted in the past by other FICs. The change to a 15,000-word dissertation was, however, approved for courses commencing in October 2021 or later.

M.Sc. (by research) in Rural and Environmental Sciences

- The M.Sc. by research in Rural and Environmental Sciences did not open in October 2020, and a review of the programme of study was carried out in advance of the February 2021 call for applications, with slight amendments being made to one of the elective study units following a change in unit coordinator. Six part-time students were then admitted in February 2021. The decision to defer the start date till February was partly due to the works being carried out at the Rural Sciences Farmhouse, which

would have made it impossible to provide new students with an acceptable standard of research space.

New courses under development

- Work on a proposed new 30-ECTS short certificate course titled “Introduction to Agriculture”, planned to be held at the Gozo Campus, was carried out during 2020/2021. Although the Stage 1 proposal for this programme was completed, this was not submitted to APQRU as it was decided to shift focus to providing a similar course to be offered jointly with the Centre for Liberal Arts and Sciences.

Major strategic initiatives planned for 2021/2022

The potential accreditation of the B.Sc. (Hons) in Earth Systems by the Institute of Environmental Management and Assessment (IEMA), the largest professional body for environmental practitioners worldwide, is being explored by the Course Coordinator, Dr Belinda Gambin. Such an accreditation would benefit future graduates by aligning their qualifications with an international professional industry-focused body. B.Sc. (Hons) in Earth Systems graduates would be entitled to use the GradIEMA suffix, hence improving their employment prospects both locally and abroad. This would, in turn, help to make the course more attractive to potential applicants, thus helping to boost student numbers. The accreditation process would require a meticulous cross-mapping of the course content with IEMA’s core requirements, and this would be followed by an audit process. The possibilities of obtaining a government scholarship to cover the annual partnership are also being explored.



Discussions and preparations were conducted during 2020/2021 in relation to plans to relaunch the dual degree programme previously offered jointly by UM and James Madison University (JMU) in the US. The programme is coordinated by Dr Elisabeth Conrad, and was originally launched as the M.Sc. in Sustainable Environmental Resources Management (M.Sc. SERM) programme, later modified to the M.Sc. Environmental Management and Sustainability (M.Sc. EMS). All teaching was conducted at UM's Valletta campus, with staff from James Madison University visiting as necessary to deliver intensive lecture blocks. Over the years between its launch in 2009/2010 and the last time the programme was offered in 2017/2018, a total of 123 students (42 from Malta, 75 from the US and 6 from other countries; 66 female and 57 male) obtained this dual degree.

One of the main changes being implemented is that students on the new programme will spend the first semester (August to December) at JMU in Virginia, then travelling to Malta for the second semester (January to May), and being free to complete their final project (June and July) at a location of their choice. It is hoped that this change will impart a more tangible 'dual degree' experience, allowing Maltese students to also gain experience on a US university campus. Discussions also explored how to provide accommodation options on or close to campus in both countries, and the offer of an accommodation bundle as part of the programme, thus eliminating the need for students to make independent accommodation arrangements.

Minor changes are also being made to the curriculum, to reflect changing priorities, student needs, and teaching capacities. It is envisaged that the programme will comprise a set of core courses together with a choice between two elective streams - one focusing on living resources (biodiversity/food systems) and one focusing on sustainable innovation (industrial ecology/energy, water, waste). Work on defining the curriculum, including mapping out the distribution of study-units, was carried out together with staff from JMU, and curricular changes were submitted for approval by both universities.



Professor Louis-F Cassar accepted an invitation to join a Steering Committee on the proposed setting up of an outreach and research facility that would cater for all public garden spaces that occur between the Pieta Pinetum and the Mall in Floriana, including the outer Argotti, Sa Maison (Gnien tal-Milorda) and St Phillip's gardens, through a major project headed by the Principal Permanent Secretary, in which it was hoped that the University's Inner Argotti (the Argotti Botanic Gardens & Resource Centre) would be a key partner. It is expected that this initiative will offer UM students more opportunities for research and consequently also improve their job prospects on graduation.



Professor Louis-F. Cassar is to take a two-year sabbatical between October 2022 and September 2024. This will necessitate the appointment of a new Director of the Institute as well as a new Head of the Environmental Management and Planning Division. Professor Cassar has been at the helm since 1990, after the then Director of the International Environment Institute, Dr Anthony Macelli, took on an overseas appointment with the U.N. Professor Cassar was responsible for steering the Institute through its move to become a conjoint UM institute in 1994 and through its merger with the Institute of Agriculture in 2010 to form the current Institute of Earth Systems.



Discussions were held during 2020/2021 regarding a potential new tailor-made course for Plant Health Inspectors to be offered both at the University and at the Malta College of Arts, Science and Technology (MCAST), with the involvement of the Permanent Secretariat for People and Standards within the Office of the Prime Minister. It was decided not to pursue this initiative due to a number of difficulties which arose during the discussions.



Since Professor Anton Micallef is due to retire in September 2022, it is expected that a member of staff, yet to be identified, from the Division of Environmental Management and Planning will take over as Head of the Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD).

Appendix A: Student numbers on IES courses during 2020/2021

	ADMITTED	Gender		Nationality		Withdrawn	Suspension/extension of studies	FINISHED THE YEAR	Gender		Nationality		GRADUATED	Gender		Nationality	
		male	female	local	international				male	female	local	international		male	female	local	international
Diploma in Agriculture	11	5	6	10	1	5	0	6	4	2	6	0	7	5	2	7	0
B.Sc. (Hons) in Earth Systems - Year 1	30	12	18	23	2	9	0	21	9	12	16	5	NA	NA	NA	NA	NA
B.Sc. (Hons) in Earth Systems - Year 2	NA	NA	NA	NA	NA	0	0	15	6	9	13	2	NA	NA	NA	NA	NA
B.Sc. (Hons) in Earth Systems - Year 3	NA	NA	NA	NA	NA	0	0	21	10	11	18	3	24	12	12	21	3
B.Sc. (Hons) in Mediterranean Agro-ecosystems Management - Year 1	7	6	1	5	2	2	0	5	4	1	4	1	NA	NA	NA	NA	NA
M.Sc. in Natural Environment and Resources Management	14	6	8	11	3	2	6	12	6	6	10	2	11	5	6	10	1
M.Sc. by research in Rural and Environmental Sciences	6	4	2	5	1	1	0	5	4	1	5	0	3	1	2	2	1