Bachelor of Science in
Geography and Geosystems

SECOND YEAR

Academic Year 2023/2024

Programme Coordinator: Dr Audrey Morley (she/her) and Dr Terry Morley (he/him)
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Office Hours: Tuesdays 14:00-15:00 and Thursdays 14:00-15:00

All students are cordially invited to address any issues, and questions, they may have about the program or modules with your program coordinators. Make an appointment or drop into our office hours.

Before the beginning of Year Two, students will choose two of the four possible pathways in (1) Coastal and Marine Sciences, (2) Ecosystem Sciences, (3) Environmental planning and policy, and (4) Palaeo-Sciences.

- ***Pathway 1: Coastal and Marine Sciences***

This pathway allows students to become proficient in both Oceanography and Coastal Sciences with an option to enhance their knowledge of sedimentary systems. The provision of trained graduates in Marine and Coastal Sciences is essential to underpin Ireland's use of national aquatic resources, as outlined in the Marine Knowledge, Research and Innovation Strategy 2017-2021, which highlights the renewed focus by the State on the value of the marine sector to the Irish economy. Students choosing this pathway will be better placed to identify in which area of Irelands marine sector they are best placed to make a contribution and develop a career.

- ***Pathway 2: Ecosystem Sciences***

This pathway reinforces the identification and evaluation of terrestrial and marine ecosystems. Students taking this pathway will be able to perform in situ environmental assessment for a variety of physical settings and environments. These skills are all highly relevant for young professionals intending to work in the private or public institutions involved in research and monitoring of our coastal, marine, and terrestrial ecosystems (i.e., Marine Institute, EPA, BIM, GSI, NPWS, An Taisce, and county councils).

- ***Pathway 3: Environmental Planning and Policy***

This pathway will expose students to the role of environmental planning in policymaking. Students will be able to evaluate the relationships between environment and society at relevant local, national, and international scales. Students will apply various conceptual frameworks, including social-ecological systems and human-environment interaction theory, to explore and understand the importance of environmental planning to better secure necessary ecosystem goods and services over the long-term across a range of terrestrial, coastal, and marine environments. Students will learn major national and EU policies, how such legal bodies govern resource use and provide regulatory space for planning objectives, and how to apply field-based assessments to develop conservation tools consistent with management goals at various ecosystem and human scales.

- ***Pathway 4: Palaeo-Sciences***

This pathway exposes students to long-term environmental change and how it relates to modern environmental systems and issues. Gaining this long-term perspective provides students with an appreciation for the history of Earth's dynamic systems, which is crucial if we want to understand and estimate future environmental change.

Learning Outcomes for Year Two

On the successful completion of year two, students will be able to:

- Identify and differentiate among the basic principles and theories of biogeography.
- Apply the standard field methodologies and data analysis techniques currently used to analyse and examine environmental problems.
- Assess and evaluate human impacts on the environment and apply modern conservation strategies to these issues.
- Explain the principles and mechanisms of Anthropogenic climate change
- Demonstrate an awareness of the rates and timescales over which processes operate and landforms develop.
- Assess critically and identify physical vs. human controls on our physical landscape.
- Identify and discuss sources of Irish Planning Law
- Evaluate the planning process critically.
- Perform statistical analysis on a variety of datasets using specialised statistical software packages.
- Assess critically which statistical analysis is most suitable for a given environmental problem.

PW 1: Coastal and Marine Sciences

- Describe the biogeochemical cycling of O_2, CO_2, and nutrients in the oceans
- Explain how the temperature, salinity, and density structure in the ocean arises and be able to distinguish different water masses on a T-S diagram
- Discuss the formation and global distribution of biogenic marine sediments
- Identify the short- and long-term processes shaping coastal landforms
  Understand the complex suite of integrated pathways that connect the land (catchment science), coast, marine, and human systems.

PW 2: Ecosystem Sciences

- Describe and characterise environments (terrestrial, freshwater, marine) based on structure, function, and identify the major controlling factors within each ecosystem.
- Apply environmental survey techniques in the field.
- Design a field-based investigation based on an environmental and/or geographical issue.
- Report and interpret field data in a professional manner.
- Understand the importance and factors determining plant diversity and conservation and their role for sustainable future development.

PW 3: Environmental Planning and Policy

- Assess the role of environmental planning in policy-making.
- Explain and discuss the use of environmental planning tools.
- Demonstrate a comprehensive understanding of the relationships between society, the environment and planning.
- Identify formal and informal institutions, which govern human uses of terrestrial, coastal, and marine environments at local, national, and international levels.
- Discuss the sources of Irish Environmental Law
- Critically discuss the pollution licencing process

- Conduct research on environmental law issues

PW 4: Palaeo-Sciences

- Describe the principles of stratigraphy.
- Describe marine and terrestrial depositional environments.
- Discuss Irish geological history in terms of environmental change.
- Discuss the formation of Quaternary deposits and their climatic forcing.
- Use examples from Earth history to explain how Earth's climate changes on various timescales.
- Conduct a field-based investigation of long-term environmental (climate and ecosystems) processes
- Report and interpret field data in a professional manner.

Timetables and Module outlines for Semester 1

Year 2 - Semester 1 PW1				
	Code	Title	ECTS	Sem.
CORE	*TI216*	*Weather & Climate*	*5*	1
	TI235	*Biogeography*	*5*	1
	LW217	*Environmental Legislation*	*5*	*1*
	ST2001	*Statistics for Data Science 1*	*5*	*1*
PW1	*EOS213*	*Introduction Ocean Sciences*	*10*	*1*

Semester 1	Monday	Tuesday	Wednesday	Thursday	Friday
09:00 09:30					TI216
10:00 10:30				TI235	TI216
11:00 11:30		EOS 213 (ST237 L1*)		ST2001 L2*	
12:00 12:30					
13:00 13:30	EOS 213				
14:00 14:30		ST2001 L2* (see note)			LW217
15:00 15:30		EOS213 P*	TI235	ST2001 P	LW217
16:00 16:30	ST2001 L1*	EOS213 P*			
17:00 17:30	ST2001 P		EOS 213		

Note: EOS 213: practical's will be from 2-3.30pm, 3.30-5pm and 5-6:30pm on a Tuesday. Note students will take their first ST2001 lecture on Monday 4-5. For the second ST2001 lecture, Students can take either the Tuesday 2-3 PM slot (in which case They will take a later EOS213 practical) OR the Thursday 11-12 slot.

Year 2 - Semester 1 PW2				
	Code	Title	ECTS	Sem.
CORE	*TI216*	*Weather & Climate*	*5*	*1*
	TI235	*Biogeography*	*5*	*1*
	LW217	*Environmental Legislation*	*5*	*1*
	ST2001	*Statistics for Data Science 1*	*5*	*1*
PW2	*BPS202*	*Aquatic Plant Sciences*	*5*	*1*
	TI2107	*BioGeo Field Trip - TM*	*5*	*1*

Semester 1	Monday	Tuesday	Wednesday	Thursday	Friday
09:00 09:30				BPS202 L W1-6	TI216
10:00 10:30	BPS202 L W1-6	BPS202 L W1-6		TI235	TI216
11:00 11:30		ST2001 L1*		ST2001 L2*	
12:00 12:30					
13:00 13:30	ST2001 P	TI2107 BioGeo			
14:00 14:30	BPS202 P# W1-6	ST2001 L2*			LW217
15:00 15:30			TI235	ST2001 P	LW217
16:00 16:30	ST2001 L1*				
17:00 17:30	ST2001 P		TI2107 BioGeo		

L – Lecture; *T* – Tutorial; *P* – Practical; Note: L* student attends 2 lectures a week, P student attends one 2h practical; Note: Practicals may be finalised after registration, depending on modules. Please monitor your NUIG email inbox for specific instructions.

CORE: TI216 Weather & Climate

Lectures	Friday: 09:00 - 11:00 Venue: AM200 / Fottrell theatre
Coordinator:	Dr. Gordon Bromley
E-mail	gordon.bromley@nuigalway.ie
Telephone:	091 – 492128
Office Hours:	TBD

Course Overview:
This course is designed to provide students with applied example of weather and climate phenomena that have a strong impact on human activities. Each week will focus on an acute environmental problem that will be explained and analysed in in-class exercises. Case studies will focus on weather (e.g. storms, hurricanes, drought, flooding) and climate (e.g. past climate change and future global warming) events to provide students with context.

Learning Outcomes:

- Sketch and explain simple diagrams, maps, or figures relating to weather and climate related
- environmental issues.
- Explain extreme weather events (including storms and heat waves) in Ireland.
- Explain risks associated with global warming for Ireland and Europe.
- Discuss mechanisms controlling global and regional climatologies (e.g. Monsoons, El Niño)
- Diagram and explain positive and negative feedbacks in climate systems
- Use examples from Earth history to explain how Earth's climate changes on a variety of different
- timescales
- Comprehend a basic weather map. This course is designed to provide students with applied example of weather and climate phenomena that have a strong impact on human lives.

CORE: TI235 Biogeography

Lectures	**Wednesday 15:00-15:50 & Thursday 10:00 -10:50 (both IT250)**
Coordinator:	Dr. Terry Morley
E-mail	Terry.morley@nuigalway.ie
Teaching Assistant:	Mr. Thomas Gorman
E-mail	t.gorman1@nuigalway.ie
Office:	Room 102, Discipline of Geography
Telephone:	091 – 493897
Office Hours:	Tuesdays 3-4, or by appointment.

Course Overview:

This class provides an introduction to the study of biogeography. Bridging the fields of biology (particularly ecology) and geography, biogeography is the study of the spatial patterns of biological diversity and its causes. We will identify how historical, physical, and biological factors affect present and past distributions of individuals, species, populations, communities, and ecosystems. The actions of humans are a critical force impacting other species, and the human influence on past, present, and future species distributions is a central topic in this module.

Aims and Objectives:

In addition to offering a survey of the basics of biogeography via class lectures, this course also aims to introduce students to various methodologies used in biogeographic research. Hands-on field, lab, and data analysis exercises will allow students to put learned concepts into practice, and give students experience working with the techniques used by biogeographers.

Learning Outcomes:

- To identify and differentiate the basic principles and theories of biogeography
- Application of standard field methodologies and data analysis techniques used in biogeography to analyse and examine applied problems
- To assess and evaluate human impacts on species distributions and apply modern conservation strategies to these issues

CORE: LW217 Environmental Legislation

Lectures	**Friday 14:00-16:00 Venue: ENG-G047**
Coordinator:	Dr. Ronan Kennedy
E-mail	ronan.m.kennedy@nuigalway.ie
Office:	Cairnes 217
Telephone:	091 – 495626

Course Overview:
This course treats of the legal regime regulating planning and development in Irish Law. The Irish planning code and issues of statutory interpretation and public law arising therefrom are examined. The course looks at: the institutions of planning control; the application for planning permission; participation by objectors; the appeal process and judicial review of planning decisions; and compensation for refusal of development. At the end of the module, students will have knowledge of the central principles of planning law and the structure of the system including the development plan, the concept of 'development', procedure for application for planning permission, rights of appeal, and enforcement of the law. In addition, special attention will be paid to specific topics such as the constitutionality of legislative restrictions on land use as well as developments in the law including the enactment of the Planning and Development (Strategic Infrastructure) Act 2006, the Planning and Development (Amendment) Act 2010, and the Environment (Miscellaneous Provisions) Act 2011.

CORE: ST2001 Statistics for Data Science 1

Lectures	**Mon 16:00-17:00: Online (L1)** **Tue 11:00-12:00, AMB-1021 (L1)** **Tue 14:00-15:00, AC201 (L2)** **Thu 11:00-12:00, Online (L2)**
Practical	**Mon 17:00-18:00, AM PC Suite 201** **Tue 18:00-19:00, Finnegan PC Suite** **Thu 15:00-16:00, Finnegan PC Suite**
Coordinator:	Dr. Emma Holian
E-mail	ronan.m.kennedy@nuigalway.ie
Office:	ADB-G011
Telephone:	091 – 495490

Note: ST2001: Students can access a tutor for online Q&A at any one (or more) of the four optional listed times as needed. Students will take two lectures and one practical weekly. Which lecture slot you are assigned will depend on your chosen PW, so check your email for directions.

Course Overview:
The course introduces probabilistic and statistical methods needed to make reasonable and useful conclusions from data. Topics include probabilistic reasoning, data generation mechanisms, modern techniques for data visualisation, inferential reasoning and prediction using real data and the principles of reproducible research. The course will rely heavily on R (a free open-source language) and will include examples of datasets collected in a variety of domains.

Learning Outcomes:
- Calculate conditional probabilities and probabilities for random variables from standard distributions (Binomial, Poisson, Normal).
- Summarise data numerically (centre and spread) and graphically (e.g., bar charts, line, area, boxplots, histograms, density plots, scatterplots) with an emphasis on best practice for communication.
- Summarise the importance of probabilistic based sampling schemes (e.g., simple random sampling, stratified sampling, cluster sampling).
- Summarise the difference between observational and experimental studies and the principles of experimental design.
- Perform probability calculations about the sample mean and use them to make inferential statements using the Central Limit Theorem.

- Calculate interval estimates for parameter estimation in one sample problems using classical and computational (i.e., bootstrap) approaches.
- Perform hypothesis testing (null and alternative hypotheses, type I and II errors and p-values) in a variety of scenarios.
- Fit and interpret a simple linear regression model.
- Compile a statistical report, i.e., prepare a typed document which introduces the statistical research question being explored, describes the data collection mechanism, provides subjective impressions on relevant numerical and graphical summaries, and outlines conclusions from all formal statistical analyses undertaken.

Pathway 1: EOS213 Introduction to Oceanography

Lectures	**Mon 13:00-14:00, Martin Ryan Annex 201** **Tue 11:00-12:00, Martin Ryan Annex 201**
Practical	**Tue 14:00-15:30 Martin Ryan Annex Lab** **Tue 15:30-17:00 Martin Ryan Annex Lab** **Tue 17:00-18:30 Martin Ryan Annex Lab**
Coordinator:	Dr. Rachel Cave
E-mail	rachel.cave@nuigalway.ie
Telephone:	091 – 492351

Course Overview:
This module will cover fundamental interactions between the oceans, atmosphere, and the seafloor. Students will study how physical, chemical, biological, and geological properties and processes shape the ocean we have today, and the key role of the oceans in Earth's climate.

Learning Outcomes:
- Explain the processes that exchange energy and water within the Earth system
- Describe the main sources, sinks and pathways of material in the oceans
- Explain how the temperature, salinity and density structure in the ocean arises and be able to distinguish different water masses on a T-S diagram
- Explain how waves and tides are generated in the oceans and how these generate currents
- Recognise the difference between Eulerian and Lagrangian co-ordinate systems and measurement techniques and be able to represent them graphically
- Describe the process of hydrothermal circulation of seawater through the seabed and resulting transformations in the chemistry of seawater
- Describe the biogeochemical cycling of O2, CO2 and nutrients in the oceans
- Discuss the formation and global distribution of biogenic marine sediments
- Carry out calculations of volume transport and fluxes of material in the oceans
- Grasp the breadth of instrumentation used in oceanography and understand how a subset of these work and how they are used in oceanographic research

Pathway 2: BPS202 Aquatic Plant Science

Lectures (Week 1 – 6)	**Mon 10:00-11:00** **Tue 10.00-11.00** **Thu 09.00-10.00**
Practical	**Mondays 14:00-16:00** **Mondays 16:00-18:00**
Coordinator:	Dr. Dagmar Stengel
E-mail	dagmar.stengel@nuigalway.ie

Telephone:	091 – 493192

Course Overview:
This module will introduce key aspects of the biology of aquatic photosynthetic organisms including seaweeds, microalgae, and aquatic plants. In particular it explores the aquatic environments including lakes and marine systems as habitats for aquatic plant and algal growth and provides fundamentals of algal diversity, functionality and ecology, and plant/algal environment interactions. ***BPS202 comprises three lectures and one 2-hour practical weekly. NOTE: Check Blackboard for Venue!***

Learning Outcomes:

- Describe and characterise environments (terrestrial, freshwater, marine) suitable for algal growth, with particular detail on growth requirements and controlling factors regarding seaweeds and phytoplankton
- Provide an overview of different algal reproductive strategies and life cycles
- Outline and appreciate the importance of different algal groups (including both microalgae and macroalgae) in ecology and their applications in biotechnology
- Appreciate the diversity of different algal groups, their distinguishing biological features including morphological growth forms
- Identify common representatives of native Irish algal groups
- Describe and appreciate the different interactions between algae and their abiotic (physical, chemical) and biotic (living) environments

Pathway 2: TI2107 Field Studies in Biogeography

Lectures	**Tue 13:00-14:00, AC115**
Coordinator:	Dr. Terry Morley
E-mail	Terry.morley@nuigalway.ie
Teaching Assistant:	Mr. Thomas Gorman
E-mail	t.gorman1@nuigalway.ie
Office:	Room 102, Discipline of Geography
Telephone:	091 – 493897
Office Hours:	Tuesdays 3-4, or by appointment.

Course Description:
This module covers the biogeographical approach to field studies. The module will comprise of preparatory seminars that cover the concepts and techniques used to design and implement a field study. Students will gain an understanding of the methods used to collect primary data and put them to practice as part of a field excursion. The field component will evaluate habitat(s) complemented with data collection and using appropriate methods to ensure accuracy and consistency. The field excursion will be followed by group and individual work involving data analysis and interpretation and the production of a research report.

Aims and Objectives:

1) Develop theoretical and methodological underpinnings of biogeography via analysis of different methodologies and key papers in field studies.
2) Develop competency in Biogeographical Field Studies via a small field investigation, collection of data consistent with key methodologies.
3) Technical report writing via analysis and interpretation of field data presented in a report format.

Learning Outcomes:

- Understand biogeographical and conservation approaches in Ireland and internationally
- Evaluate the various techniques of collecting ecological data.
- Apply relevant technique(s) to examine biogeographical patterns relevant to Ireland.
- Present synthesised and critically evaluated information in graphical & written forms.

Semester 2

Year 2 - Semester 2 PW3				
	Code	*Title*	*ECTS*	Sem.
CORE	*TI255*	*Earth Surface Processes and Landforms*	*5*	2
	ST2002	*Statistics for Data Science II*	*5*	2
	EOS2102	*From Core to Crust*	*10*	2
PW3	*TI2104*	*Marine Spatial Planning*	*5*	*2*
	LW358	*Environmental Law II*	*5*	*2*

Semester 2	Monday	Tuesday	Wednesday	Thursday	Friday
09:00 09:30					EOS2102
10:00 10:30	TI2104				*TI255*
11:00 11:30		ST2002 L1*		ST2002 L2*	
12:00 12:30		EOS2102			
13:00 13:30	EOS2102	TI2104		EOS2102 P*	
14:00 14:30		ST2002 L2*			LW3124
15:00 15:30			TI255	EOS2102 P*	LW3124
16:00 16:30	ST2002 L1*				
17:00 17:30				EOS2102 P*	

L student attends 2 lectures a week*
P student attends 1 practical slot per week*

Year 2 - Semester 2 PW3			
	Code	*Title*	*ECTS*

CORE	*TI255*	*Earth Surface Processes and Landforms*	*5*
	ST2002	*Statistics for Data Science II*	*5*
	EOS2102	*The Earth: From Core to Crust*	*10*
PW4	*TI2108*	*Introduction to Palaeoclimatology*	*5*
	TI2106	*Fieldcourse in Palaeoclimate*	*5*

Semester 2	Monday	Tuesday	Wednesday	Thursday	Friday
09:00 09:30					EOS2102
10:00 10:30	TI2108				*TI255*
11:00 11:30		ST2002 L1*		ST2002 L2*	
12:00 12:30		EOS2102			
13:00 13:30	EOS2102	TI2108	TI2106	EOS2102 P*	
14:00 14:30		ST2002 L2*	TI2106		
15:00 15:30			TI255	EOS2102 P*	
16:00 16:30	ST2002 L1*				
17:00 17:30				EOS2102 P*	

Note: ST2002: Students attend 2 lectures a week and can access a tutor for online Q&A at anyone (or more) of the four optional listed times as needed; P student attends 1 practical slot per week*

CORE: TI255 Earth Surface Processes and Landforms

Lectures	**Wednesday 15:00-15:50 (IT250 Theatre, 1st Floor)** **Friday 10:00 -10:50 (AMB-1023 Mairtin O Tnuthail Theatre**
Coordinator:	Dr Kevin Lynch
E-mail	kevin.lynch@universityofgalway.ie
Office:	125a
Telephone:	091-49-5779

Course Overview:

The purpose of this module is to train students on the physical principles used to understand some basic questions about the Earth's physical landscape: how do natural physical systems (e.g., coastal beach-dune systems; river catchment systems) behave today? how did they behave in the past? and, based on the answers to the first two questions, can we predict how they will behave in the future? In order to answer these questions, we examine the characteristics of different processes (water, wind, slope, weather) that shape different landforms in different regions of the world, including some classic case studies in Ireland. This course examines landscape form and function, working through the theoretical understanding of the landscape to hands-on practical fieldwork by collecting, analyzing, and presenting data. Emphasis is put on critical analyses of the process-landform models (e.g., sediment transfers; system equilibria) operating on different time scales (seconds to millennia).

A core aspect of the course will focus on using a field-based systems approach, emphasizing (1) the connectivity of the different components of our landscape, and (2) how our landscape responds to human and natural pressures.
(Language of instruction: English)

Learning Outcomes:

- Identify a single landform unit on the physical landscape and the controlling processes that formed and shaped it.
- Identify the short- and long-term drivers shaping a landscape through different temporal and spatial scales of analyses.
- Critically assess and identify physical vs. human controls on our physical landscape; communicate and interpret human impacts on the environments and conceptualize the problems of managing natural systems.
- Critically evaluate the different field and laboratory methods used in analyzing and interpreting the origin and evolution of landforms.
- Hone key professional skills such as research preparation, data collection, and analysis; and report writing, these will be done using a field-based assignment.
- Stimulate the development of a constructive interdisciplinary culture of peer collaboration, review, and consultation; these will be done using a field-based assignment.

CORE: EOS2102 The Earth: From Core to Crust

Lectures	**Mon 13:00-14:00 MR Annexe lecture theatre (MRA201)** **Tue 12:00-13:00 MR Annexe lecture theatre (MRA201)** **Fri 09:00-10:00 MR Annexe lecture theatre (MRA201)**
Practical	**Thu 13:30 – 14:45 Quadrangle A206 in EOS** **Thu 15:00 – 16:15 Quadrangle A206 in EOS** **Thu 16:30 – 17:45 Quadrangle A206 in EOS**
Coordinator:	Dr Shane Tyrrell
E-mail	shane.tyrrell@nuigalway.ie
Telephone:	091 – 49 4387

Note: There are four in person practical labs and four online assignments Tutors and demonstrators will help you both in the lab and will guide you through the online assignments. You will be assigned a specific tutor for the full 12 weeks – your tutor will be in touch in weeks 1 or 2 to organise a time for the online tutorial that will suit the group.

Course Overview:
This course will investigate the entire earth system, from core to crust, through geological time and from a range of scales. Students will learn about the origins of the Earth and the broad-scale tectonic forces that underpin the formation and destruction of continents. The module will investigate the composition of the crust from both mineralogical and resource-potential perspectives and examine the processes that modify and sculpt the surface of our planet. Students will study the evolution of life and the interaction between the biosphere and earth, including the impact of geology on human civilisation. This will be carried with a specific focus on current geohazards and the future challenges facing our planet.

Learning Outcomes

- Discuss the origins of the Earth and the solar system
- Identify a variety of earth materials, minerals and resources and appreciate their origin, occurrence, and geological significance

- Visualise the Earth and its geology in 3D and describe the techniques used to image the subsurface of the planet
- Explore large-scale earth structure and plate tectonics
- Describe the operation of earth surface processes and how the sedimentary record provides an archive of palaeoenvironmental change through geological time
- Describe a range of current risks and geohazards and examine the impact of these on our planet
- Identify a range of fossil materials and have an appreciation for the evolution of the biosphere and its impact on earth

CORE: ST2002 Statistics for Data Science 2

Lectures	**Mon 16:00-17:00: McMunn Theatre (L1)** **Tue 11:00-12:00, AMB-1023 (L1)** **Tue 14:00-15:00, McMunn Theatre (L2)** **Thu 11:00-12:00, AMB-1023 (L2)**
Coordinator:	Dr. Emma Holian
E-mail	emma.holian@nuigalway.ie
Office:	ADB-G011
Telephone:	091 – 495490

Course Overview:
This course will provide an introduction to commonly used techniques in statistics when analyzing data from experiments and observational studies. Topics include classical and modern methods in interval estimation, regression models for prediction problems, modern approaches for visualizing multivariate data, and the principles of reproducible research.

Learning Outcomes
- Conduct and interpret a two-sample and paired t-test using classical hypothesis testing and modern computational approaches.
- Conduct and interpret a chi-square test using classical and computational approaches. Use Simple Linear Regression (SLR) to make inferences about relationships between a response variable and an explanatory variable.
- Check the assumptions underlying a SLR model.
- Apply methods to visualize multivariate data (e.g., radar plots, case profile plots, heatmaps).
- Apply hierarchical clustering techniques (e.g., nearest neighbours) in multivariate data.
- Compile a statistical report, i.e., prepare a typed document which introduces the statistical research question being explored, describes the data collection mechanism, provides subjective impressions on relevant numerical and graphical summaries, and outlines conclusions from all formal statistical analyses undertaken.

Pathway 3: TI2104 Marine Spatial Planning

Lectures	**Mon 10:00-10:50 (IT250 Theatre, 1st Floor)** **Tue 13:00 -13:50 (IT125G – Theatre, ground floor)**
Coordinator:	Dr Liam Carr
E-mail	liam.carr@nuigalway.ie
Office:	Room 104, Discipline of Geography
Telephone:	091 – 49 2314

Course Overview:
Marine spatial planning is promoted as a means of managing multiple human uses of the marine environment in a more sustainable manner than other approaches. This module focuses on the historical importance and context of the marine sector in securing economic and cultural goods, critiquing various single- and multi-sector planning and management regimes. Using case studies both from Ireland and abroad, this module covers: social-ecological systems, the social construction of the marine environment, ocean governance and citizenship, drivers of marine spatial planning, ecosystem-based planning and management, and the collaborative planning of marine resources. (Language of instruction: English)

Learning Outcomes

- Identify formal and informal institutions which structure human uses of the marine environment.
- Interrogate formal and informal institutions through the application of appropriate geographic theories and concepts to develop an informed and intellectually grounded critique.
- Apply geographic theories and concepts to marine and coastal social-ecological systems.
- Creatively analyse, synthesise, and present results and conclusions effectively and comprehensively, both orally and in written form.
- Contribute effectively to the existing body of geographical and environmental knowledge through discussion, reading interpretation and analyses, and formative writing.

Pathway 3: LW3124 Legislation for Environmental Scientists

Lectures	**Friday 14:00-16:00 Venue: AC203**
Coordinator:	Dr Ronan Kennedy
E-mail	ronan.m.kennedy@nuigalway.ie
Office:	Cairnes 217
Telephone:	091 – 495626
Office Hours:	TBC

Course Overview:
This module exposes students to the considerable amount of environmental legislation that exists in Ireland. It encourages students to think about how the legislation is implemented and how it could be used in their future careers. This module will examine the legal aspects of a number of different sources of pollution including water pollution (inland and coastal), air pollution, waste, noise etc. The common law nuisance principles and the rule in Rylands v Fletcher will be examined, as well as recent case law in this area. Relevant domestic legislation (in particular the Water Pollution Act and the Air Pollution Act) as well as EU developments will be considered, particularly from the point of view of monitoring and penalties for breach. At the end of the module, students will have knowledge of the central principles of pollution control law and the structure of the system including the institutional arrangements, the role of the Environmental Protection Agency, and the development of Integrated Pollution Controls. In addition, special attention will be paid to specific topics such as wildlife protection, climate change, eco-system management, and access to information.
Learning Outcomes:

- Consider both national and European legislation in the context of its impact on environmental quality
- Deconstruct legislation with reference to the purpose of the legislation, the powers within the legislation, the offences and penalties contained in the legislation construct
- Consider, using real life scenarios, the legislation that could be used in such scenarios for the betterment of the environment

Pathway 4: TI2108 Introduction to Palaeoclimatology

Lectures	**Mon 10:00-10:50 (Tyndall Theatre)** **Tue 13:00 -13:50 (MY129 Lecture Hall 2)**
Coordinator:	Dr Aaron Potito
E-mail	aaron.potito@nuigalway.ie
Office:	Room 118, Discipline of Geography
Telephone:	091 – 49 3936
Office Hours:	TBD

Course Overview:
Climate change is not a modern phenomenon, as Earth's systems are dynamic and rarely stable over extended periods of time. Climate variability occurs across multiple spatial and temporal scales, but we generally lack long enough scientific or historical records to directly measure most long-term patterns of climate change. Palaeoenvironmental Studies fills this void by offering evidence of environmental conditions across timescales, providing a broader context for studying modern environmental phenomena.

Learning Outcomes:

- Demonstrate an understanding of long-term environmental change as it relates to modern environmental systems
- Critique the array of methodologies which are used in reconstructing past environments
- Assess long-term human-environment interactions through time
- Apply theoretical concepts in a real-world context through hands-on field-based instruction

Pathway 4: TI2106 Field Studies in Palaeoclimate

Lectures	**Wed 13:00 – Teaching Lab AC 217**
Coordinator:	Drs Aaron Potito & Audre Morley
E-mail	aaron.potito@nuigalway.ie & audrey.morley@nuigalway.ie
Office:	Room 118 & 109, Discipline of Geography
Telephone:	091 – 49 3936 & 091 49 4104
Office Hours:	TBD

Course Overview:
'Field Studies in Palaeoclimate' will provide students with hands-on experience in conceptualising, planning, and conducting field-based research in Quaternary climate and environmental change. The module focuses on key periods in Earth's recent history during which our atmosphere, oceans, landscapes, and ecosystems underwent pronounced shifts and asks students to investigate the causes and nature of those shifts, and their implications for our future. Assessment is continuous and comprises preparatory seminars and context-building group discussion, participation in field work and lab-based analysis of those data, and data synthesis.

Learning Outcomes:

- Conceptualise the principal components of Earth's climate system
- Evaluate sites for specific scientific analysis and create site-specific methodologies
- Perform foundational sedimentary and palaeoecologic sampling procedures in the field
- Perform foundational analytical measurements and data collection in the lab
- Identify and outline critical limitations and key areas for future research in this discipline