ENVS264

Introduction to Geographic Information Science

S1 External 2019

Dept of Environmental Sciences

Contents

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General Information

Unit convenor and teaching staff
Lecturer
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Email to schedule an appointment, available for a quick chat after each lecture

Lecturer
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Email to schedule an appointment

Credit points
3

Prerequisites
ENVS117 or COMP115 or COMP125 or ISYS100 or ISYS104 or STAT170 or STAT171

Corequisites

Co-badged status

Unit description
This unit provides students with a comprehensive introduction to geospatial technologies, including geographic information systems (GIS), global positioning systems (GPS) and remote sensing. Students will learn core concepts and develop technical skills in data acquisition and management, mapping and spatial sampling and analysis. Students are provided training using the latest commercially available geospatial software. This unit covers the application of geographic information science across a range of disciplines, including environmental science and management, physical and human geography, urban planning and biodiversity conservation.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software

Organise, analyse and interpret geographic or spatial information using a range of techniques

Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence

Communicate the outputs of geographic/spatial analysis in both map and written formats

Apply standard Geographic Information Science concepts and techniques to a range of contexts

Assessment Tasks

Name	Weighting	Hurdle	Due
Progress Task 1	1%	No	08-Mar-2019
Progress Task 2	1%	No	15-Mar-2019
Assignment 1	20%	No	05-Apr-2019
Assignment 2	20%	No	10-May-2019
Progress Task 3	1%	No	17-May-2019
Progress Task 4	2%	No	31-May-2019
Quiz	5%	No	7-June-2019
Final Exam	50%	No	Check the exam timetable

Progress Task 1

Due: **08-Mar-2019**
Weighting: **1%**

Progress task 1: An Introduction to ArcGIS

On successful completion you will be able to:

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software

- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Progress Task 2

Due: **15-Mar-2019**
Weighting: **1%**

Progress task 2: Mastering Coordinate Systems

On successful completion you will be able to:

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Communicate the outputs of geographic/spatial analysis in both map and written formats

Assignment 1

Due: **05-Apr-2019**
Weighting: **20%**

A report on Weeks 2 - 5 lab-based Practical Exercise

On successful completion you will be able to:

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Communicate the outputs of geographic/spatial analysis in both map and written formats
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Assignment 2

Due: **10-May-2019**
Weighting: **20%**

A report on weeks 6 - 9 Practical Exercises

On successful completion you will be able to:

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Communicate the outputs of geographic/spatial analysis in both map and written formats
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Progress Task 3

Due: **17-May-2019**
Weighting: **1%**

Progress Task assessment based on week 10 exercise

On successful completion you will be able to:

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Progress Task 4

Due: **31-May-2019**
Weighting: **2%**

A report on Weeks 11-12 Practical Exercises

On successful completion you will be able to:

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques

- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Quiz

Due: **7-June-2019**
Weighting: **5%**

One short quiz on ALL lecture topics

On successful completion you will be able to:

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Final Exam

Due: **Check the exam timetable**
Weighting: **50%**

Final Exam

On successful completion you will be able to:

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Communicate the outputs of geographic/spatial analysis in both map and written formats
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Delivery and Resources

ENVS264 is an introductory course to Geographic Information Systems (GIS). It provides students with a comprehensive introduction to geospatial technologies, including GIS, Global

Positioning Systems (GPS) and Remote Sensing. Students will learn core concepts and principles of GIS, and develop technical skills in data acquisition and management, mapping, spatial sampling and analysis. Students are trained using the latest commercial geospatial softwares.

ENVS264's lectures cover a range of topics which are key to one becoming competent in Geographic Information Science. These include a background on how the shape of the earth impacts on mapping, also reffered to as coordinate systems and map projections, creating and collecting GIS data, spatial analysis using different GIS data types, the art of map making, remote sensing and working with three-dimensional features or data. The practical classes are designed to expose students practice and apply standard GIS concepts and techniques to a range of disciplines, including environmental science and management, physical and human geography and urban planning and biodioversity conservation.

Delivery

This unit is offered both internally and externally.

Lecture program and location

There is one 1 hour lecture per week. Please check lecture times and rooms at the Macquarie University timetables website (www.timetables.mq.edu.au). Lectures are recorded and posted to iLearn via Echo360. Internal students are expected to attend lectures *in person*; external students can access lectures recordings through the iLearn.

Practical program and location

Internal students: Students are enrolled to one 3 hour practical class per week. Please check practical times and rooms at the Macquarie University timetables website (www.timetables.mq.edu.au). Practical class sizes are limited by the number of available computers. You must use the online enrolment system to change the time/day of your practical class. Practicals begin in Week 1.

External students: You must have a home computer with a Windows operating system (Windows 7 or above). Please note that ArcGIS software is NOT supported by Mac or Linux operating systems. Also, we don't provide IT support for installation to Mac or Linux platforms. A copy of the ArcGIS software will be provided to external students. You must install this software on your computer. Internal students could also request a copy of the software and license to install to their personal computers.

Workload

ENVS264 earns 3 credit points towards your degree. You are expected to invest at least 9 hours of study per week on average over the semester. This includes your lectures and practical exercises (4 hours per week), assignments and the final exam.

Submission of assignments and progress tasks

All students are required to keep a backup of the submitted version of their assessments.

Assignments should be in a MS Word or PDF file format. All maps and tables associated with the assignment must be incorporated in the MS Word document or PDF.

Students are not permitted to email their assignments or submit them in a softcopy format. Assignments are to be submitted via the Turnitin link provided in iLearn by 5PM on the date specified.

How do I request an extension?

Extensions must be requested by email from the unit convenor prior to the assignment's due date (except in exceptional circumstances), and supported by appropriate documentation (e.g. a medical certificate).

Extensions will only be granted in writing (by email) at the discretion of the unit convenor. Otherwise, automatic penalties will apply. Assignments that are handed in late without an extension or exceptional circumstances will not be marked if they are submitted more than 7 days after the due date. **If submitted within 7 days, marks will be deducted for lateness at a rate of 5% of the possible mark per day.**

Return of marked assignments

Your assignments will be returned via iLearn within two teaching weeks of the submission, and will include written feedback.

Requirements to complete this unit satisfactory

1. Attend lecture and practical classes (internal students);

2. Complete all assignments and the final exam; and

3. Acquire a pass grade or above.

Grades for the unit as a whole will be awarded according to the following general criteria (course rubric).

	Developing	**Functional**	**Proficient**	**Advanced**
General description of the level of attainment	Has not yet reached the desired standard. Limited understanding of required concepts and knowledge. A **fail** grade (or under some circumstances a conceded pass) would be given	Has reached basic academic standards. Work has limited translation of concepts and procedures to new contexts unless aided. A **pass** grade would be awarded	Has completely reached the standards expected. Can work independently in new contexts, adapting procedures to meet the context. Demonstrates awareness of own limitations. A **credit** grade would be awarded.	Has gone beyond the expected standards. Exhibits high levels of independence and can use concepts to generate new ways of completing procedures. Can engage in critical reflection. A grade of **distinction** or **high distinction** would be awarded.

Resources

Technology used

This unit will use the online platform of Echo360 and iLearn, ArcGIS, Google Earth, MS Excel software, GPS, and online resouyrces such as Lynda.com for the practical exercises.

You will require access to a computer and broadband internet to complete this unit. The library computers and computer labs are available for casual use outside scheduled practical classes.

Internal students who have a home computer with a Windows operating system may obtain a copy of the ArcGIS software from the unit convenor. **The ArcGIS software is NOT supported by Mac or Linux operating systems.** It is not essential for internal students to have ArcGIS installed on their home computer as the computers in the computer labs are available for casual use outside scheduled practical classes. **However, external students must have ArcGIS installed on their home computer.**

Unit web page

This unit's webpage will be available on iLearn. Information about how students can access iLearn can be found at: http://www.mq.edu.au/iLearn/student_info/index.htm

The iLearn page uses Macquarie University's standard interface and has links, access to lectures (as audio files through Echo360, and as downloadable PDF presentations) and practical instructions. Important announcements will be made through iLearn, so check the ENVS264 page regularly.

Information about how to access lecture recordings through the Echo360 EchoCenter page in iLearn can be found at: http://mq.edu.au/iLearn/student_info/lecture_recordings.htm

Recommended texts/materials

Chang, K. 2008. *Introduction to geographic information systems.* McGraw Hill, New York. [Available at Macquarie University Library].

Burrough PA, McDonnell RA, and Lloyd C. 2015. *Principles of Geographic Information Systems*. Oxford University Press, UK. . [Available at Macquarie University Library].

Huisman O, de By RA (Eds). *Principles of Geographic Information Systems: An Introductory Text Book*: Available online at:https://www.itc.nl/library/papers_2009/general/PrinciplesGIS.pdf

Unit Schedule

Week	Lecturer	Lecture date	Lecture	Practical	Assessment	Assessment due date
1	Maina&Andrew	26 Feb	Introduction to Geographic Information Science: what is GIS, what is it used for, career pathways in GIS and learning GIS at Macquarie.	An Introduction to ArcGIS (PT1)	Progress Task 1	9-Mar-2019
2	Maina	5 Mar	Planet Earth is not, in fact, perfectly round: Coordinate systems and map projections	Methods for analyzing non-spatial data (Assignment 1)	ProgressTask2	15-Mar-2019
3	Maina	12 Mar	Types of GIS data: Vector Data	Geoprocessing methods (Assignment 1 cont'd)	Assignment 1	5-Apr-2019

4	Maina	19 Mar	The art of map making	Geoprocessing methods (Assignment 1 cont'd)	Assignment 1	5-Apr-2019
5	Maina	26 Mar	Capturing physical features on earth surface using GIS	Geoprocessing methods (Assignment 1 cont'd)	Assignment 1	5-Apr-2019
6	Maina	2 Apr	Types of GIS data: Raster Data	Data Capture	Assignment 2	10-May-2019
7	Guest Lecture	9 Apr	Career in general and in Spatial Information Science	Geo-referencing and Digitising	Assignment 2	10-May-2019
			13 - 28 Apr: SESSION 1 BREAK			
8	Michael	30 Apr	Starting a GIS Project: Data Flow Diagrams & ModelBuilder, ArcGIS Pro	Raster Analysis	Assignment 2	10-May-2019
9	Michael	7 May	Remote Sensing: Surface elevation and Terrain products, raster and TIN, 3D	Preparation and Presentation of Maps	Assignment 2	10-May-2019
10	Michael	14 May	Remote Sensing of Environment	Remote Sensing	Progress Task 3	17-May-2019
11	Maina	21 May	Geo-scripting: coding GIS tasks using R scripting language	Using R for GIS	Progress Task 4	31-May-2019
12	Guest Lecture	28 May	Remote Sensing Applied to detecting Land Use/Cover Change	Using R for GIS	Progress Task 4	31-May-2019
13	Maina	4 Jun	Unit summary: End of semester Exams; careers in GIS & SIS at Macquarie	No practical	Quiz 1	7-Jun-2019

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy

- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcome

- Organise, analyse and interpret geographic or spatial information using a range of techniques

Assessment tasks

- Progress Task 2
- Assignment 1
- Assignment 2
- Progress Task 3
- Progress Task 4
- Quiz
- Final Exam

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of

techniques
- Communicate the outputs of geographic/spatial analysis in both map and written formats

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Assessment task

- Final Exam

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Assessment tasks

- Progress Task 1
- Assignment 1
- Assignment 2
- Progress Task 3
- Progress Task 4

- Quiz
- Final Exam

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Communicate the outputs of geographic/spatial analysis in both map and written formats
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Assessment tasks

- Assignment 1
- Assignment 2
- Progress Task 3
- Progress Task 4
- Quiz
- Final Exam

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Perform basic operations using Geographic Information Systems (GIS) and Remote Sensing software
- Organise, analyse and interpret geographic or spatial information using a range of techniques
- Identify and define key concepts and principles of Geographic Information Science, including scale, projections, interactions and interdependence
- Apply standard Geographic Information Science concepts and techniques to a range of contexts

Assessment tasks

- Assignment 1
- Assignment 2
- Progress Task 3
- Progress Task 4
- Quiz
- Final Exam

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcome

- Communicate the outputs of geographic/spatial analysis in both map and written formats

Assessment tasks

- Progress Task 2
- Quiz
- Final Exam

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcome

- Organise, analyse and interpret geographic or spatial information using a range of techniques

Changes from Previous Offering

1. Introduced progress tasks as part of the assessments and practical exercise
2. Geo-scripting practicals in R are now assessed
3. Introduced career in SIS and in general
4. New guest lecture on applied remote sensing