FACULTY OF SCIENCE

School of BEES

GEOS9016

Principles of Geographic Information Systems

Session 2, 2020

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Faculty of Science - Course Outline

1. Information about the Course

NB: Some of this information is available on the UNSW Handbook

Year of Delivery	2020
Course Code	GEOS9016
Course Name	Principles of GIS
Academic Unit	School of BEES
Level of Course	Postgraduate
Units of Credit & Workload	6UOC The normal workload expectations of a student are approximately **25 hours per term for each UOC**, including class contact hours, other learning activities, preparation and time spent on all assessable work. Expected workload (**6 UoCx25)= 150 hours**
Session(s) Offered	Session 2
Assumed Knowledge, Prerequisites or Co-	Familiarity with the Windows operating system.
Hours per Week	Equivalent of 4 hours 'contact' per week. One weekly activity is online synchronous (ie. video conference through **via Microsoft Teams**). You can download Teams and other Microsoft programs at myIT
Number of Weeks	10 WEEKS
Commencement Date	Week 1 (beginning 1st June 2020)

Summary of Course Structure (for details see 'Course Schedule')

Component	HPW	Time	Day	Location
Lecture	2	Mon 09-11 (wk1, 3-5)	Monday	online
Laboratory	2	Mon 11-13 (wk1,3-5)	Monday	Online synchronous learning activity.
Lecture	1	Mon 10 - 11 (wk 7-10)	Monday	Online
Laboratory	3	Mon 11 – 14 (wk 7 -10)	Monday	Online synchronous learning activity
Special Details				

2. Staff Involved in the Course

Staff Role	Name	Contact Details	Consultation Times
Course Convenor	Prof Graciela Metternicht	chat through MS Teams g.metternicht@unsw.edu.au.	By appointment for a one-on-one Zoom or MS Teams session.
Course demonstrator	Sophia German and Graciela Metternicht	sophia.german@unsw.edu.au	Designated lab times only.

3. Course details

Course Description (Handbook Entry)	Approximately 80% of all data collected have associated geographic attributes, and there is an increasing need for people with the skills and abilities to manipulate and make sense of that information. This course provides an introduction to, and understanding of, the basic principles, structures, procedures and applications of geographic information systems and science. Topics covered in the course provide a comprehensive overview and practical experience in the analytical treatment of geographical information, including: information sources; data storage, representation and visualisation; projections and coordinate systems; the analysis of spatial data to generate new information; and the dissemination of such digital information through avenues including the internet.
Course Aims	The main objective of this course is to provide students with the principles of how to manage and use GI Systems and Science to deal with real world issues. This is both to aid in the management of those issues, and to gain a better understanding of those issues.
Course Learning Outcomes (CLOs)	• Create and edit maps using specialised software such as ArcGIS • Create models for geographic information systems analysis using specialised software such as Arc GIS, and apply these to project applications • Discuss the advantages and disadvantages of different data models, data structures and types, and map projections • Understand and apply basic spatial analysis techniques, including topographic analysis • Evaluate the main spatial information sources and data storage options for mapping data In terms of the UNSW **Science Faculty Graduate Attributes**, you will be expected to develop experience in attributes (1) Research, inquiry and analytical thinking abilities, (2) Capability and motivation for intellectual development, (5) Teamwork, collaborative and management skills and (6) Information literacy.
Major Topics (Syllabus Outline)	Data models, data structures, types and sources Map projections Spatial interpolation Metadata Topology and geoprocessing Map algebra & fuzzy logic Topographic analysis Map making See the lecture sequence for timings.
Relationship to Other Courses within the Program	Almost any course in BEES, and many courses from outside BEES, will be dealing with spatial phenomena. The approaches we deal with in this course allow you to conduct spatial analyses in a consistent and repeatable manner, using geo-referenced data in vector and/or raster formats.

[3] http://learningandteaching.unsw.edu.au/content/LT/course_prog_support/course_outline_template.cfm?ss=2#Template

Graduate Attributes Developed in this Course		
Science Graduate Attributes[5]	**Select the level of FOCUS** *0 = NO FOCUS* *1 = MINIMAL* *2 = MINOR* *3 = MAJOR*	**Activities / Assessment**
Research, inquiry and analytical thinking abilities	3	*All will be achieved through the assessments*
Capability and motivation for intellectual development	3	*As above*
Ethical, social and professional understanding	1	*As above*
Communication	2	*As above*
Teamwork, collaborative and management skills	3	*As above*
Information literacy	3	*As above, plus in the software training*

4. Rationale and Strategies Underpinning the Course

Teaching Strategies	Online blended learning (synchronous and asynchronous) supported by flexible access to course materials, activities and assessments. Synchronous lab sessions are delivered through the UNSW communication platform Microsoft Teams. Recorded sessions of lectures and tutorials are available on Moodle. Students are expected to interact in the online labs and other synchronous activities to be planned during the Term, as this provides a better learning environment (as opposed to being talked at for an hour). Lecture and laboratory notes are provided on Moodle as support material, as is a discussion forum. Relevant papers and other documents are accessible through the UNSW library web site. **Synchronous learning?** This is a form of education where learning *occurs at the same time* (e.g. students connect to a video lecture or lab on Mondays from 9-11 am) but not in the same place. In the context of this course, the term is used to mean online learning in which students learn from instructors, or peers **in real time**, **but not in person**. For example, weekly labs via video conferences using Microsoft Teams, interactive webinars, chat-based online discussions via Moodle Forums, and lectures that are broadcast at the same time[1]. **Asynchronous learning?** In this course it means instruction and learning that occurs **not only in different locations, but also at different times**. For example, prerecorded video lessons made available via Moodle, email exchanges between lecturer and students, and online discussion boards. [1].
Rationale for learning and teaching in this course	GI Systems are fundamentally technical in nature, in that one needs to use software to achieve one's aims. However, while this course includes a software training section, its primary focus is not about teaching software. It is about the principles of GI Science (software changes rapidly, principles do not). Consequently, there are three elements that you should use for learning in the course. The textbook provides a broad overview of the subject, and is a good source of initial reference before you use the broader scientific literature. In the case of the software, there are detailed online manuals that should be referred to. These include both command references and tutorials. Finally, there are your colleagues in the course.

[1] From https://www.edglossary.org/synchronous-learning/

	You are all working on similar problems, and you are encouraged to learn together. The Moodle discussion forum is provided to assist in this process. As with all courses at university, you are expected to do much of the learning yourself. The lectures are used to give you an introduction to the subject area, and the labs are there to reinforce this. A more detailed understanding must be gained outside of class time, normally as part of your assessment tasks. The assessment tasks have been aligned with the expected learning outcomes as closely as possible. You are also strongly encouraged to delve further into the field of GIS and its applications, particularly as they relate to applications you are interested in.
Access to the lecturer	I am available via Microsoft Teams during the designated times of lecture, and the labs devoted to the projects. If you encounter a problem outside of the scheduled contact periods, then what you should do depends on the nature of the problem. **If your problem is conceptual**, then please contact me by email or contact via MS Teams chat to arrange a time to discuss it. I often have other meetings, so this will help manage your time and mine. If possible, please provide a short summary of the area or topic you need help with to allow me to prepare for the meeting. Many of the challenges in this course are technical in nature. In turn, many of these technical problems are common to the entire course. So, **if your problem is technical and related to the software**, then please follow these five steps. 1. **Stop and think**. You will often be able to solve the problem with a little of your own brain power. I have found that walking away from the computer and doing something else for half an hour is a very effective approach. (Let your subconscious mind do some work). 2. **Read the manual**. The manuals we are using have detailed explanations of many of the tasks you might wish to do with a GIS. They should be your next port of call. It will take a bit of time initially while you get used to the mindset of the software developers, but once learnt they are very useful. The software also has an extensive online database of bug reports and solutions, and is available through the web. http://desktop.arcgis.com/en/documentation/ 3. **Ask someone else (using Microsoft Teams)** if they have encountered the same problem – they may know the answer (and it is good to talk to people…). If you are not familiar with the communication platform MS Teams read: https://student.unsw.edu.au/teams-students 4. **Post a question to the course Moodle discussion board or email the lecturer**, or send a message to the lecturer via MS Teams. Read the list of postings first, in case someone has already answered the question. The discussion board will be regularly checked (usually twice daily) to post answers and check factual accuracy of other answers. Where they are relevant to the whole course, email queries will be anonymously copied to Moodle. 5. **If your problem has still not been solved, then please contact the lecturer to make an appointment.** Don't stew on the problem forever. The five steps are actually the approach you will need to use in the workforce, so it is a good learning exercise in itself.

5 Course Schedule and Structure

The schedule/order of lectures may change as the course demands.

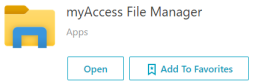
Wk	Week Starting	Hours	Topics – Lecture Mondays (9 – 11 wk 1, 3-5) (10 – 11 wk 7-10)	H	Topic Practical Mondays (11 – 13 wk 1, 3-5); (11 – 14 wk 7 – 10)	Assessment Due Dates
1	01-Jun-2020	2	Introduction Data models, data structures, types and sources. Map projections	2	Intro to ArcGIS, import data for project	
2	08-Jun-2020	2	PUBLIC HOLIDAY	2	**PUBLIC HOLIDAY**	
3	15-Jun-2020	2	Metadata Spatial interpolation	2	Map projections	Software training 1 and 2 (via myEsri) by the end of the week.
4	22-Jun-2020	2	Error Topology	2	Spatial interpolation	
5	29-Jun-2020	2	Map Algebra Geoprocessing: raster and vector	2	Metadata Error	DEM Report Due Sunday 5th July 2020
6	06-Jul-2020		Flexible week - NO LECTURES or LABS			
7	13-Jul-2020	1	Spatial Analysis: Fuzzy logic	3	Major Project	Software training 3 (via myEsri) by end of week.
8	20-Jul-2020	1	Surface analysis Data output: Making a map	3	Major Project	
9	27-Jul-2020	1	Q&A	3	Major Project	Major Project due by end of week
10	03-Aug-2020	1	Course summary and things you would love to know about the exam		No lab	

6. Assessment Tasks and Feedback: summative assessments

Task	Knowledge & abilities assessed	Assessment Criteria	% of total mark	Date of		Feedback		
				Release	Submission	WHO	WHEN	HOW
Software training	Basic GIS principles and software familiarity.	See below	**10**	Week 1	Wk 3 Wk 7	Metternicht	Wk 4 Wk 8	Marks
DEM report (individual)	See the CourseLearning Outcomes section.	See below	**10**	Week 1	End Week 5	Metternicht	Monday Wk 8	Marks
Major project (Group Work)	See the course Learning Outcomes section.	See below	**50**	Week 1	End week 9	Metternicht	Week 11	Marks
Examination	See the course Learning Outcomes section.		**30**		**Timed online moodle exam**	Metternicht	Exam period	Marks

To pass the course, students must achieve a mark of at least 40% for the major report and complete the software training by the end of Term.

7. Additional Resources and Support

Text Books	**Primary references:** 1 **Delaney, J. and Van Niel, K.P., 2007.** Geographical Information Systems, An Introduction, 2nd edition. Oxford University Press. 2 **Burrough, P.A., McDonnell, R., McDonnell, R.A. and Lloyd, C.D., 2015.** *Principles of geographical information systems*. Oxford university press. These will not be used as standard textbooks we follow in the course. They are reference text to begin a search in the wider literature. You can buy them from UNSW Bookshop. Free GIS online textbooks: https://volaya.github.io/gis-book/en/gisbook.pdf https://www.gislounge.com/two-arcgis-books-free-esri/ Principles of geographic information systems : an introductory textbook. https://research.utwente.nl/en/publications/principles-of-geographic-information-systems-an-introductory-text-4 Documentation for ArcGIS: https://doc.arcgis.com/en/ And https://pro.arcgis.com/en/pro-app/tool-reference/main/arcgis-pro-tool-reference.htm **Other references that can be accessed online at UNSW Library** 3 Essentials of Geographic Information Systems (2011). Jonathan Campbell, UCLA, MIchael Shin, UCLA. ISBN 13: 9781453321966. Online access through UNSW library. 4 Tomaszewski, Brian. Geographic Information Systems (GIS) for Disaster Management. CRC Press, 2015 5 Johnson, Lynn E. E. Geographic Information Systems in Water Resources Engineering. CRC Press, 2016. 6 Tomaszewski, Brian. Geographic Information Systems (GIS) for Disaster Management. Taylor and Francis, 2014. 7 Lawhead, Joel. Learning Geospatial Analysis with Python : an Effective Guide to Geographic Information System and Remote Sensing Analysis Using Python 3. 2nd ed., Packt Publishing, 2015. 8 Favorskaya, Margarita N., and L. C. Jain. Handbook on Advances in Remote Sensing and Geographic Information Systems : Paradigms and Applications in Forest Landscape Modeling. Springer International Publishing, 2017.
Course Manual	Lab instructions and course notes will be made available on the Moodle system.
Readings	These are listed in the lecture notes and on the course web site on Moodle. Others are available, or will be made available, through the library's Leganto platform (see the link on the course Moodle site).
Recommended Journals and Conference Proceedings	See below.
Societies	Surveying & Spatial Sciences Institute (SSSI) http://www.sssi.org.au
Computer Laboratories or Study Spaces	You will have remote access to the software via http://myaccess.unsw.edu.au/ . (https://www.myaccess.unsw.edu.au/user-guides In connecting remotely it is advisable that you get the app myAccesss File Manager 

8. Required Equipment, Training and Enabling Skills

Equipment Required	A computer with sufficient internet bandwidth to run remote desktop software (citrix receiver). A student version of ArcGIS will be made available to you, and it can also be accessed through http://myaccess.unsw.edu.au/
Enabling Skills Training Required to Complete this Course	Additional training modules for the ArcGIS software are available if needed. Check the self-directed ESRI Virtual Campus courses for ArcGIS Desktop at http://training.esri.com Many of these are free for UNSW students. The courses to enrol in, and the order in which they are to be completed, are: 1. Getting started with GIS 2. Using Raster Data for Site Selection 3. Building Models for GIS Analysis Using ArcGIS These can be accessed via https://www.esri.com/training/catalog/search/ (once you have your login). Some additional courses that might be of use, but which are optional and not part of the assessment, are: 1. Basics of Geographic Coordinate Systems 2. Distance Analysis Using ArcGIS

9. Course Evaluation and Development

Mechanisms of Review	Comments or Changes Resulting from Reviews
CATEI and My Experience	This course has evolved over fifteen years of delivery at UNSW, and it has been developed from a GIS course taught at a university which itself evolved over a decade. The software training was added in 2010 because GIS software skills were identified as a major limiting factor for students in the course. This was converted from a monolithic course with a single deadline to a series of rolling deadlines in 2018. The overall duration for this component is now also shorter. In 2018, the DEM report has been changed to a more standard report plus metadata, where previously the content was to be entirely in the metadata format. In 2020 the course has been adapted to be delivered fully online.

10. Administrative Matters

Expectations of Students	Most School of BEES policies can be found at http://www.bees.unsw.edu.au/current-students Students need to treat this course as if it was a face-to-face course. Review the course outline carefully and create a work and assignment schedule in relation to your other courses to stay on track. Do not go a whole week without connecting with the course – experience from other courses show that students who do this generally get low marks or sometimes fail. Failure to submit assignments may be used as grounds to exclude you from the examination.		
Assignment Submissions	**The project reports are to be submitted** through Moodle. **Do not email them to me.** **Extension requests** need to be discussed with me well in advance of the due date. **Late Submission**: *The school policy is 10% (of the assignment mark) for each day late – up to a maximum of seven days after which assignment will receive 0. Consideration for relief from this rule can be given only for documented reasons (and the student should submit documentation through Student Central).*		
Occupational Health and Safety[8]	http://www.bees.unsw.edu.au/ohs		
Assessment Procedures[9]	As per UNSW policy. http://my.unsw.edu.au		
Equity and Diversity	Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course Convenor prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or http://www.studentequity.unsw.edu.au). Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made. Information on designing courses and course outlines that take into account the needs of students with disabilities can be accessed via http://www.studentequity.unsw.edu.au/disability-services		
Grievance Policy[10]	**School Contact**	**Faculty Contact**	**University Contact**
	BEES Grievance Officer A/Prof Scott Mooney s.mooney@unsw.edu.au	Associate Professor Alison Beavis Deputy Dean (Education) UNSW Science mailto:a.beavis@unsw.edu.au	Student complaint procedures at https://www.gs.unsw.edu.au/policy/documents/studentcomplaintprocedure.pdf University Counselling and Psychological Services Kensington Level 2, East Wing, Quadrangle Building T: +61 (2) 9385 5418 E: counselling@unsw.edu.au Office Hours: 9:00am - 5:00pm Monday to Friday

[8] UNSW Occupational Health and Safety: http://www.ohs.unsw.edu.au/
[9] UNSW Assessment Policy: http://www.gs.unsw.edu.au/policy/documents/assessmentpolicy.pdf
[10] UNSW Student Complaint Procedure: https://www.gs.unsw.edu.au/policy/documents/studentcomplaintproc.pdf
[11] University Counselling and Psychological Services

11. UNSW Academic Honesty and Plagiarism

What is Plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one's own.
*Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne

12. BEES Academic Honesty and Plagiarism

Please note:

In addition to the UNSW Policy on Academic Honesty and Plagiarism, the School of Biological, Earth and Environmental Sciences (BEES), also considers any work submitted that has been produced outside of a given course in a given year to be plagiarism i.e:

- Work produced for a third party e.g. your place of employment, is considered intellectual property of the third party, and as such if such work is submitted in place of a required course work, it is deemed plagiarism.
- All work submitted for assessment must be created specifically for the given assessment task in the given year. Work produced in previous years or for other assessments is not acceptable.

13. **Marking criteria for the software training**

The training includes multiple choice quizzes at the end of each component.

Marks will be assigned proportional to the number of sections completed by their respective due dates. For example, if you have successfully completed 2 of the 3 components by their due dates then you will be awarded 66.7% of the total marks for that piece of assessment.

If you are not sure how many sections you have completed then you can access it through the course status link at the upper left of the page (the icon looks like a bachelor degree hat).

Any sections not completed by the due date must be completed by the end of semester.

Access to the training will be allocated via an invitation to the UNSW organisation on the my.esri.com system, after which you can self enrol in the course. Completion status will be assessed during one of the labs.

Please do not go back and re-do the quizzes after you have completed them, as that will reset them. Print and upload the 'certificate of completion' of the Training and upload in Moodle. If you like to re-do the quizzes, do that after the certificate has been submitted.

The **courses to enrol in, and the order in which they are to be completed, are**:

1. Getting started with GIS
2. Using Raster Data for Site Selection
3. Building Models for GIS Analysis Using ArcGIS

These can be accessed via https://www.esri.com/training/catalog/search/ (once you have your login).

Some additional courses that might be of use, but which are optional and not part of the assessment, are:

1. Basics of Geographic Coordinate Systems
2. Distance Analysis Using ArcGIS

14. **Marking criteria for the DEM report**

In terms of Biggs' SOLO taxonomy, a High Distinction will be Relational, a Pass will be Unistructural.

You are to describe the development of your DEM, and provide the DEM with appropriate metadata.

The DEM you are to describe is the one you interpolated in the DEM lab (this is the one using the ANUDEM algorithm[2], which is in the Topo to Raster tool).

You are also to submit a map using a selection of data for the Smith's Lake study site. There are no marks assigned to the map. It is to be submitted so you receive feedback on map construction well before the final report. *Failure to submit this map will result in a zero mark for this piece of assessment.*

Marks will be awarded for the quality of the writing in the same way as for the major project, and for the completeness and correctness of the metadata. This could cover, for example, accuracy of the DEM, accuracy of the source data and their impact on the DEM's accuracy, tests of logical consistency and the like.

References must be provided where appropriate using the Harvard system of referencing (see the

[2] http://desktop.arcgis.com/en/arcmap/latest/tools/spatial-analyst-toolbox/how-topo-to-raster-works.htm

major project criteria).

You are to edit your metadata using the ISO format. DO NOT USE THE FGDC FORMAT.

Further details about formats will be provided nearer the date of submission.

The following are errors made in previous years. You should not make them.

1. People generate metadata for the incorrect file. Pay attention to the list above.
2. Metadata was written for the map document. Do not write metadata for the map document (the mxd file).
3. People did not provide references.
4. People did not adequately describe the lineage (how they generated the data) in the metadata.

15. **Marking criteria for the major report**

The approach used in marking is based on Biggs' (2003)[3] Structure of the Observed Learning Outcome (SOLO) taxonomy (table 1). There is also a set of words that describe the grades and marks (table 2). Reading these tables should aid your understanding of what I am looking for in your projects in relation to the specific marking criteria.

Table 1. Biggs' SOLO taxonomy. This is a hierarchical taxonomy, listed from lowest to highest level. Achieving a higher level implies exceeding the lower levels. There is also no direct translation between grades and SOLO levels, as it depends on the level of the course and the nature of the assignment.

Level	*Verb examples*
Prestructural	Misses the point
Unistructural	Identify, do simple procedure
Multistructural	Enumerate, describe, list, combine, do algorithms
Relational	Compare/contrast, explain causes, analyse, relate, apply
Extended abstract	Theorise, generalise, hypothesise, reflect

Table 2. Grade and mark interpretation

Grade	*Mark*	*Description*
High Distinction	85+	Work of exceptional quality showing clear understanding of the subject matter and appreciation of issues; well formulated; arguments sustained; maps and diagrams where relevant; relevant literature referenced; marked evidence of creative ability; solid intellectual work.
Distinction	75-84	Work of very high quality showing strong grasp of subject matter and appreciation of dominant issues, though not necessarily of the finer points; arguments clearly developed; relevant literature referenced; evidence of creative ability; solid intellectual work.
Credit	65-74	Work of solid quality showing competent understanding of subject matter and appreciation of main issues, though possibly with some lapses and inadequacies; arguments clearly developed and supported by references, though possibly with minor red herrings and loose ends; some evidence of creative ability; well prepared and presented.
Pass	50-64	Adequate answers; reasonably relevant and accurate. Sufficient to merit a bare pass to safe pass mark.
Fail	<50	

[3] Biggs, J. (2003) Teaching for Quality Learning at University, second edition. Society for Research into Higher Education & Open University Press, Buckingham, UK.

In terms of Biggs' SOLO taxonomy, a High Distinction is Extended Abstract, while a Pass is Multistructural. More generally, to achieve a pass you must implement the models as instructed and show that you understand what you have done. To achieve a High Distinction you must have implemented some innovations of your own (gone beyond the instructions). Very well written reports that clearly show an understanding of what has been done, but that contain no innovations, will receive a maximum grade of Distinction.

Throughout your project report you are expected to demonstrate an understanding of:

1. the meaning of your results,
2. the rationale for doing it,
3. potential sources of error and their impact on your conclusions.

I will also be looking for:

1. *Clarity*

Clear, simple, grammatical language used. All terms are explained.

2. *Argument and structure*

Is the argument clearly and logically developed through the report? Are the points in the appropriate sequence (do your points build on previous points presented)?

3. *The wider scope*

Do you place your work in the context of the broader, peer reviewed, literature? You should have no fewer than ten references. More than this number is provided to you in the lab notes so it is a simple target to achieve.

4. *Map composition and diagrams*

Are they clear and do they display the desired information? Are they used to support your arguments and not purely as decorative material? Do your maps have a scale bar, north pointer and legend? Are appropriate and consistent colour schemes used?

5. *Innovation*

This is the degree to which you go beyond the instructions given in the lab handouts, for example assessing the sensitivity of the model to parameter variations or implementing better models.

6. *Referencing*

Appropriate use of the Harvard referencing system. There are several formatting variations with the Harvard system. Have a look at a sample of journals to get an idea, for example the International Journal of Geographical Information Science. I do not mind which one you use so long as it is consistent throughout the report. One exception to this is that you do not list all authors in the main text where there are three or more authors (eg. Use "Border et al., 1999" rather than "Border, Taylor, Waugh, and Ponting, 1999"). Such a long style is awkward and unwieldy when there are more than three authors. However, you must list all authors in the reference list at the end of the document. Please see https://student.unsw.edu.au/referencing for a good introduction on how to do referencing.

Please note that the EndNote bibliography management software is freely available to UNSW Staff and students. See https://www.it.unsw.edu.au/students/software/index.html. Learning how to use this software will make writing assignments much easier, and will solve most of your problems with referencing formats (so long as your database is correct). Most online databases now allow you to export references directly into EndNote, so constructing a database is reasonably simple.

Be careful when using web sites as a source of information. If they summarise another piece of work, then you should read and cite the original piece of work (the primary reference). This applies to lecture notes – DO NOT USE LECTURE NOTES AS REFERENCES. Use the references provided in them. In general, you should not use web sites unless they are an official publication. Wikipedia is a good example here. It is an excellent resource for locating further information, but it is not a primary reference. The same principle applies to any printed encyclopaedia.

UNSW Learning Centre has many good sources online to support writing skills. Worth a look at https://student.unsw.edu.au/writing

16. Useful Journals and Conference proceedings

GIS is a rapidly developing field, and so many useful references are available in journals and conference proceedings. Fortunately for you, these are often on the web. Most lectures will have references in the notes.

This is not a complete list, and you should search for other references using databases like Scopus and Web of Science (available through http://www.library.unsw.edu.au). These are particularly useful because they allow you to track citations to papers, and thus see who has been developing an idea (or maybe has debunked it). Please note that ScienceDirect only searches Elsevier journals, and ignores other publishers such as Taylor and Francis and Wiley. The same principle applies to the Wiley Interscience system. Google Scholar indexes articles across the quality spectrum, so care needs to be taken.

Journals

International Journal of Geographic Information Science
Transactions in GIS
Geographical Analysis
Journal of Geographical Systems
Environment and Planning, Series A
Computers and Geosciences
Mathematical Geology
Ecological Modelling
Environmental Modelling and Software
Remote Sensing of Environment
Photogrammetric Engineering and Remote Sensing
International Journal of Remote Sensing
Remote Sensing Reviews
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Conferences with online proceedings

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http://www.geocomputation.org/
GIScience series
http://www.giscience.org/
MODSIM series
https://www.mssanz.org.au/conferences.html (look for the GIS and environmental modelling sessions)