FACULTY OF SCIENCE

School of Biological, Earth and Environmental Sciences

BIOS 3161

Life in Arid Lands

Course Manual
Term 1, 2022

1. Table of Contents

2. Information about the Course

Year of Delivery	*2022*
Course Code	*BIOS 3161*
Course Name	*Life in Arid Lands*
Academic Unit	*School of Biological, Earth and Environmental Sciences*
Level of Course	*3rd Year*
Units of Credit	*6*
Session(s) Offered	*Session 1*
Assumed Knowledge, Prerequisites or Co-requisites	Prerequisites: 1 of 3: Vertebrate Zoology (BIOS2061); Invertebrate Zoology (BIOS2031); Flowering Plants (BIOS2051)
Hours per Week	*2 contact hours*
Number of Weeks	*10 weeks including field trip*
Commencement Date	14 Feb 2022

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

Component	Hours	Time	Day	Location
Tutorial 1 (Weeks 1-5)	***2***	***9-11a***	***T***	***Mathews 308***
Tutorial 2 (Week 1)	***2***	***9-11a***	***Th***	***Mathews 308***
Field Trip (Week 6)	***32***	***All day***	***23-26th March***	***Scheyville National Park***
Optional Stats Workshop (Week 8)	***2***	***9-11a***	***Th***	***BioSci G29***
Workshop: Final Presentations (Week 10)	***2***	***9-11a***	***Th***	***Mathews 308***
TOTAL				

Special Details

- A series of mandatory day field trips is run in Week 6 of Term 1. There is a course fee to cover the cost of the field trip, inclusive of daily travel from UNSW by hired bus payable in advance (catering is still being considered).
- A workshop for final presentations will be held in Week 10.

University policy requires students to attend at least 80% of lectures and labs in order to qualify for course credit. Regular attendance of lectures and labs is essential for success in this course. Attendance will be taken.

Students should check *Moodle* regularly for content, instructions and announcements. Grades will be posted on Moodle.

3. Staff Involved in the Course

Staff	Role	Name	Contact Details	Consultation Times
Course Convenor		A/Prof. Lisa Schwanz	l.schwanz@unsw.edu.au	By appointment
Additional Teaching Staff	Lecturers & Demonstrators	Dr. David Eldridge Dr. Michael Letnic Dr. Isaac Towers	d.eldridge@unsw.edu.au m.letnic@unsw.edu.au isaac.towers1@unsw.edu.au	By appointment
	Technical Staff	Guy Taseski	g.taseski@unsw.edu.au	By appointment

Field Trip Staff

A/Prof Lisa Schwanz (Course Convener)

My research focuses on the evolutionary and behavioural ecology of terrestrial vertebrates. I'm particularly interested in how animals respond to change in their environments. How do they cope behaviourally and physiologically with environmental stressors, and what does it mean for their reproduction and survival? My recent research has focused on how egg temperature impacts sexual development (male or female) and other phenotypes in reptiles. If you see a bearded dragon, catch it for me because it may be sex reversed as a result of climatic warming.

Prof. David Eldridge

I work for the NSW government and as a Professor in the School of BEES at UNSW. My research focuses on arid ecology, and I have worked in arid zones around the world for several decades. I largely focus on understanding the impacts of human-induced land uses in drylands, and the links between land-use change and environmental change. My projects cover broad areas of rangeland ecology, ecosystem engineering (the effects of organisms on soil processes), soil biology, soil chemistry, restoration ecology and microbiology.

Dr. Isaac Towers

I am a postdoc working in the Falster lab in the School of BEES. My research focus is on trying to understand why plants have evolved to employ the ecophysiological strategies that we see today, and how this helps them cope in different environments. I completed my PhD at UQ where I worked with annual plants in the semi-arid southwest Western Australian woodlands. There, I aimed to investigate whether spatial patchiness in aspects of the environment like canopy cover promoted species diversity. Here at UNSW, I work mostly on analyzing big trait data and mechanistic modelling in forest communities, specifically Eucalypt forests, with the aim of understanding how climate shapes the evolution of trait diversity.

Guy Taseski

I am a technical officer in the School of BEES. I have always had a keen interest in the natural world and have always enjoyed collecting objects to examine since childhood. I did my undergraduate degree at UNSW (2016), and it is here where I began to appreciate the plant kingdom in all its variety and form. After my degree, I worked for the National Herbarium of New South Wales, where I looked after the herbarium collection, performed curatorial duties, and collected numerous botanical specimens from across New South Wales. While originally starting out in ecology, I have shifted my focus towards taxonomy and have a keen interest in Australian Lamiaceae (particularly the genus Prostanthera), and the distribution of weeds (particularly feral opuntioid cacti).

4. Course Details

Course Description[1]	Forty-four percent of Australia is desert and a further 37% is semi-arid grassland or shrub communities. These arid lands contribute much to our unique biodiversity. This course offers advanced training in conducting independent research, in the context of Arid Zones. We examine the formation of global arid lands, the evolutionary history of the flora and fauna, adaptations of plants and animals to arid environments, the major arid lands ecosystems and conservation of biodiversity. A field trip to western Sydney is an essential part of the course and students will incur expenses.
Course Aims[2]	Life in Arid Lands recognises that the majority of Australia's land surface is desert or semi-arid tussock grassland and shrub communities, and about a third of Earth's landscapes are deserts. It capitalises on expertise in animal and plant biology to provide students with a unique opportunity to learn about life in the arid lands and receive practical research training in the field. The course combines a fundamental understanding of the adaptations of flora and fauna to life in the desert with an advanced practical training in scientific research. The course aims to: 1) Expand conceptual knowledge of organismal ecology and evolution in Arid habitats; 2) Provide skills and knowledge in ecological research, including posing research questions, designing experiments and collecting and analysing data; 3) Provide understanding of issues in research design and sampling; 4) Develop skills in data interpretation & communication in presentations and reports.
Student Learning Outcomes[3]	By the end of this course, you will have an understanding of the biology of the major arid lands in the world with a particular focus on Australia. You will get hands-on experience in the field exploring topics relevant for arid ecology. There are five, broad learning outcomes expected from this course: • Describe ecosystem functioning and organismal ecology and evolution in arid lands • Apply common methodologies for sampling plant and animal taxa • Design, implement and communicate research projects, including planning the sampling regime, data collection methods, and graphical presentation of results • Critique scientific ideas through academic discussion • Make observations from and interpret graphically-presented data

Graduate Attributes Developed in this Course[4]

Science Graduate Attributes[5]	*0 = NO FOCUS* *1 = MINIMAL* *2 = MINOR* *3 = MAJOR*	**Activities / Assessment**
Research, inquiry and analytical thinking abilities	3	• Research proposal • Data sheets • Paper discussions • Report Figures & Critique • Research Report
Capability and motivation for intellectual development	3	• Research proposal • Paper discussions • Report Figures & Critique • Research Report
Ethical, social and professional understanding	2	• Research proposal • Research Report
Communication	3	• Research proposal • Paper discussions • Report Figures & Critique • Research Report
Teamwork, collaborative and management skills	3	• Research proposal • Data sheets • Paper discussions • Research Report
Information literacy	3	• Research proposal • Paper discussions • Report Figures & Critique • Research Report

[1] UNSW Virtual Handbook: http://www.handbook.unsw.edu.au
[2] Learning and Teaching Unit: http://www.ltu.unsw.edu.au
[3] Learning and Teaching Unit – Learning Outcomes: http://www.ltu.unsw.edu.au/content/course_prog_support/outcomes.cfm?ss=0
[4] Access the contextualised Science Graduate Attributes and your mapped courses:
http://www2.science.unsw.edu.au/guide/slatig/sciga.html
(Mapped courses are available at this site)

Major Topics (Syllabus Outline)	• Global deserts in perspective • Structure and function of arid landscapes • Thermal ecology • Physiological adaptation • Community ecology and coevolution • Dealing with temporal and spatial variation
Relationship to Other Courses within the Program	This course is intended to be taken by 3rd year students pursuing a major in biology (or other 3rd year students with an interest and adequate background in biology) and interested in learning skills associated with independent research and field work. It is assumed that students will have completed one of the taxonomic diversity courses (BIOS2061-Vertebrate Zoology; BIOS2031-Invertebrate Zoology; BIOS2051-Flowering Plants) prior to enrolling in BIOS3161 (Life in Arid Lands).

5. Rationale for the inclusion of content and teaching approach

Rationale for learning and teaching in this course[5],	The course uses a variety of teaching methods to enable learning about arid land biology: lectures, blended activities on Moodle, student-led discussions, a field trip with structured activities, an independent research project, student reflection, peer-based critique and a written report. Thus, many of the teaching approaches are hands-on and involve student-based inquiry. Students are actively engaged in the learning process and challenged with interesting material linked to biology in arid lands. Students take responsibility for their learning through participation in online and in-class discussions, library research, and through design of their research projects in the field. Cooperative learning is encouraged through discussions, group projects on the field trip, and peer-based critique. As a science graduate, students should be able to understand scientific information presented in a professional and lay-person format. The assessment tasks in this course are therefore designed to develop skills associated with building and interpreting graphs, critiquing professional science, and communicating independent research in written and verbal format.

6. Teaching Strategies

Teaching Strategies	The lecturers provide students with basic concepts and key information from contemporary research in arid zones. Lecture topics are associated with student-led paper discussions to promote the development of critical thinking abilities. The field component of the course provides students with hands-on training in field research skills, as well as developing critical thinking and practical research skills through developing and implementing a group research project (3-4 students). Collaboration is essential for efficient experimental design, data collection and analysis. The projects are assessed in project proposals, individual final report, and as a group presentation. The mandatory field component involves 4 day-trips to Scheyville National Park in western Sydney. The assessments are designed to support the major aims of the course, in particular focusing on skills associated with 1) graph creation and interpretation and 2) planning a research project. The writing, speaking, discussion, and peer-critiquing components provide opportunities to develop scientific communication skills. Assessments employ both written and verbal tasks to provide participation and learning opportunities for diverse learners.

[5] LTU – Teaching Philosophy: http://www.ltu.unsw.edu.au/content/teaching_support/teaching_portfolio.cfm?ss=0#putting

7. Assessment Tasks

Instructions and assessment criteria for assignments are included in this book.

	Task	% of Total Mark	Due Date	How to Submit
Literature discussion	1. Leading Discussion Paper (group)	5	See roster on Moodle	In class
	2. Discussion Paper Questions, 3 (independent)	15 (3 papers × 5%)	11pm on the day prior to discussion: 21 February 28 February 7 March 14 March ***late submissions not allowed**	Moodle
Research project	3. Project proposal, data sheet & materials (group)	15	4pm, 11 March	Moodle
	5. Draft figures (independent)	5	4pm, 8 April	Moodle
	6. Comment on 2 peer figures (independent)	5	4pm, 14 April	Moodle
Field Reflection	9. Reflection (independent)	15	4pm, 1 April	Moodle
Project report	7. Project presentation (group)	10	21 April	In class
	8. Project Report (independent)	30	4pm, 22 April	Moodle

UNSW has a standard late submission penalty of:

- **5% per day**
- **for all assessments where a penalty applies**
- **capped at five days (120 hours), after which a student cannot submit an assessment, and**
- **no permitted variation**

8. UNSW Academic Honesty and Plagiarism Policy

PLEASE READ CAREFULLY

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.

BEES Academic Honesty and Plagiarism Policy

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.

9. Course Schedule (Please check Moodle regularly for content and instructions)

Week	Date(s)	Tutorial 1 Tuesday, 9-11am Mathews 308	Tutorial 2 Thursday, 9-11am Mathews 308	Research Project Timeline	Assessment Tasks ***See Section 13 for more details*
Week 1	**14 Feb**	**Arid Lands background and project workshopping**	**Project workshopping & crystalization**	**Intro to Scheyville, project workshopping and brainstorming**	
Week 2	**21 Feb**	**Thermal biology/Physiology Papers Physio Project refinement**	**No class**	**Project workshopping**	**Questions, Paper *Physio* (21 Feb) Discussion Leading, Group *Physio* (22 Feb)**
Week 3	**28 Feb**	**Ecosystem ecology (Eldridge) Papers Ecosystem Project refinement**	**No class Appts to discuss Proposal and Datasheet (optional)**	**Choose & refine projects; How to make a datasheet**	**Questions, Paper *Ecosystem* (28 Feb) Discussion Leading, Group *Ecosystem* (1 Mar)**
Week 4	**7 Mar**	**Temporal and spatial variation Papers Community Project refinement**	**No class Appts to discuss Proposal and Datasheet (optional)**		**Questions, Paper *Variation* (7 Mar) Discussion Leading, Group *Variation* (8 Mar) Research Proposal Due Fr, 11 March, 4pm**
Week 5	**14 Mar**	**Community ecology (Letnic) Papers Variation Proposal and Datasheet Feedback**	**No class**	**How to make good figures**	**Questions, Paper *Community* (14 Mar) Discussion Leading, Group *Community* (15 Mar)**
Week 6	**21 Mar**	**FIELD TRIP – Scheyville National Park ***See details below 23 – 26 March***			
Week 7	**28 Mar**	**No class**	**No class**		**Reflection Due Fr, 1 April, 4pm**
Week 8	**4 Apr**	**No class**	**Optional Stats Workshop – BioSci E26, G29**		**Draft Figures Due Fr, 8 April, 4pm**
Week 9	**11 Apr**	**No class**	**No class**		**Figure Peer Review Due Th, 14 April, 4pm**
Week 10	**18 Apr**	**No class**	**Group project presentations**		**Group Project Presentation (Th, 21 April) Final Research Report Due Fr, 22 April, 4pm**

10. Additional Resources and Support

Text Books	**Recommended texts (bookshop and UNSW library):** Ward, D. (2008). *The Biology of Deserts.* (Oxford University Press, London) Whitford, W.G. (2002). *Ecology of Desert Systems*. (Academic Press, New York)
Course Manual	Available in print and as a pdf file on Moodle
Required and Supplementary Readings	Discussion papers will be announced and available on Moodle
Recommended Internet Sites	Links available on Moodle

11. Course Evaluation and Development

Student feedback is gathered periodically by various means. Such feedback is considered carefully with a view to acting on it constructively wherever possible. This course outline conveys how feedback has helped to shape and develop this course.

Mechanisms of Review	Last Review Date	Comments or Changes Resulting from Reviews
Major Course Review	2018	Major revision of the course was completed in 2016 in association with a change of Course Convener. Revision in 2018 to reconfigure for 10-week course. Based on feedback provided in 2018, additional opportunity for project workshopping was added. The course assessments underwent additional revision associated with COVID-19 in 2020, 2021, 2022.
MyExperience	2020	Student comments on MyExperience evaluations will contribute to course revisions, along with other comments provided verbally and in writing throughout the course.
More/Less/Start	2016	During the field trip, students can submit anonymous requests for 'more' or 'less' of any content, as well as request a 'start' of content not available. This will occur on Day 2 of the field trip.
Other	2018	Student feedback, provided via email or verbally, is always encouraged. Please feel free to provide suggestions on how course content, structure and teaching might be improved. The following questions are intended as a guide: (1) What topics did you find most interesting? (2) What exercises did you find most enjoyable? (3) What additional topics would you have liked to see covered? (4) What aspects of the course did you find most challenging? (5) What aspects of teaching did you find most effective? (6) What aspects of teaching did you find least effective? (7) Do you have any suggestions on how the course could be improved?

12. Field Trip

SCHEYVILLE NATIONAL PARK

***** This field trip is a MANDATORY component of the course.**

12.1 Background and Overview
The purpose of the field trips to Scheyville National Park is to give you first-hand experience in arid land ecology. The park is in western Sydney; while it is not arid, the region received less rain than coastal Sydney and many topics relevant for arid ecology can be explored there. The field trips will be a consecutive sequence of day trips. Each day, you will participate in structured tutorials to learn important ecological concepts and common research methods for working in the field with plants and animals. You will also perform group research projects planned in advance to gain experience conducting field research in arid lands and to increase your scientific skill.

WHERE: Scheyville National Park, near Richmond, NSW

WHEN: 23-26 March 2022, all day

GETTING THERE:

Option 1: Self-drive; carpooling recommended

Option 2: Coach / Minibus from UNSW

More details on times and catering provided in class.

12.2 Field Trip Schedule:

Day	Dates	08:00 – 10:00	10:00 – 12:00	Lunch	13:30-17:00
1-4	23-26 March	**Field tutorial**	Group Research Projects	Guest research presentations	Group Research Projects

12.3 National Park Amenities
Communication: Mobile and data reception.

Facilities: Flush toilets

https://www.nationalparks.nsw.gov.au/visit-a-park/parks/scheyville-national-park

12.4 Required Equipment and Training

Equipment Required	**Research equipment and materials:** groups are responsible for communicating required equipment and materials to the technical officer. **Personal equipment:** 1. Strong closed-toe walking boots 2. Long pants and long-sleeved shirts to protect skin from sun and abrasions 3. Clothing suitable for outdoor wear in cold and warm weather 4. Broad-brimmed hat 5. Rain coat 6. Sunblock 7. Insect repellent 8. Water bottle **9. Gardening gloves** **10. (Head) torch** 11. Swimmers (optional) 12. Field notebook **13. Datasheets, pencils, clipboard** 14. Binoculars and camera (optional)
Enabling Skills, Training Required to Complete this Course	Understanding of Health&Safety requirements in field environment. Please see Moodle for links to necessary H&S documents.

12.5 Group Research Projects

*** see assessment details in Section 13

With the aim of enhancing independent scientific abilities and learning about arid ecosystems in more depth, students will work in groups of 3-5 to conduct group research. Projects will be chosen in advance and will require substantial planning. This includes writing a research proposal, preparing a materials list and creating datasheets on which to collect data.

You may work on any aspect of ecology (soils, birds, plants, insects, etc), but it would be nice to address concepts important for life in arid lands (e.g. importance of water, temperature, patchiness/microhabitats, facilitation). It is best if you come up with a research idea that inspires you! Teaching staff are available to help you choose an interesting and feasible project. Projects requiring handling or scaring vertebrates will not be possible, unfortunately.

Here are some suggestions:

1. Thermal preference and ecology of ants, spiders (e.g. Insect body temperatures vs time of day, habitat)
2. Bird surveys across habitats and time of day.
3. Plant composition and litter under bat boxes
4. Using copper models to examine jacky dragon body temperature at different orientations, amounts of cover, cloud cover, wind, time of day, etc.
5. Microhabitat temperature profiles vs open/sheltered, water supplemented/control
6. Activity / Seed predation by ants vs. time of day / air temperature / type of woodland
7. Island biogeography of tree/shrub outcrops.
8. Facilitation, microhabitats, or leaf litter as a function of distance from tree/shrub stands.
9. Does plant morphology vary as a function of microhabitat or community characteristics
10. Plant species composition / percent cover along water courses (e.g. drought-tolerant vs. ephemerals).
11. Plant allocation to defence, reproduction, photosynthesis, support, etc in response to competition or water.
12. Are there differences in plant facilitation beneath native and exotic shrubs?
13. Litter-dwelling arthropod communities under different shrub or tree species
14. Spatial distribution of termite mounds in relation to tree density
15. Changes in the size distribution of eucalypts
16. Leaf colour of shrubs (drought tolerant) vs herbaceous ephemerals (drought avoiders)
17. Drought tolerance of shrubs vs herbaceous (using a plant pressure chamber)
18. Pressure chamber water content of plant depending on proximity to a water source
19. Response to burning of *Bursaria*

13. ASSESSMENT TASK DETAILS

Feedback will be given in the form of marks & comments within 2 weeks after submission for each assessment. Marking rubrics will also be returned to students with their marks for the project proposal and final report.

13.1 Leading Paper Discussion (group)

During class time in Weeks 2-5, we will discuss as a class two scientific papers from the primary literature (**10 mins each**). The papers will be available on Moodle. For each paper, an assigned group of students will provide 2-3 slides oriented towards stimulating class discussion of the paper. Each student will be involved in leading discussion for one paper during the term. The grading for this is focused on 1) facilitation of class discussion – THIS IS NOT a paper presentation; 2) clear understanding of the concepts and findings of the paper; 3) description of one data figure from the paper.

Slides – 1-3 slides on Motivation, Results and Implications. Have a clear description of at least one graphical result from the paper. You will be graded down if you have too many slides. The slides should be designed to facilitate discussion. This is NOT a presentation, it is a discussion.

Leading discussion – VERY FEW STUDENTS will have read the paper. Engender class participation in discussion with broad concept questions (e.g. When you think of [TOPIC X], what images/ideas come to mind? How do the results inform the impact of climatic warming?). Consider having a 3-minute small group discussion on a question prior to class discussion. Your score will depend strongly on your ability to encourage class discussion.

Learning Objectives:
- Enhance critical thinking
- Practice presentation skills
- Practice graph explanation
- Increase leadership skills

13.2 Questions for Paper Discussion (independent)

Eight (8) total papers will be discussed in class, two per class meeting. You are encouraged to look at all of them. One class, you will lead discussion on one paper (see 13.1). For the other three class, you must read one paper that week (3 papers total) and provide short answers to questions on Moodle – due the night before the paper is discussed. The papers will be available on Moodle, along with 3-4 short-answer questions designed to encourage critical thinking. Scores will be based on accuracy, as well as depth and breadth of understanding of the paper and its implications.

You can choose the 3 papers you answer questions for, with the following rules (designed to make sure you have a breadth of topic exposure):
1. One paper per class meeting
2. You cannot answer the questions for the paper you lead discussion on
3. You cannot answer questions for the OTHER paper discussed on the same day as your discussion

As an example, Jennifer Lopez is assigned to lead discussion on Paper *Community A*, and she chooses to answer questions for Paper *Physio B,* Paper *Ecosystem B,* and Paper *Variation A* because they look the most interesting to her.

Learning Objectives:
- Enhance critical thinking
- Increase comprehension of professional scientific literature
- Improve graph interpretation skills

13.3 Group Research Project Proposal (group)

Each group will prepare a scientific proposal for their research project to be completed at Scheyville National Park. This proposal will help students learn the conceptual background to their project, improve science communication, and assist in planning the project prior to the trip. The aim of this assignment is to focus your mind on the how and why of the research, and to help you visualize the process of the research.

The Proposal should be ~4 pages single-spaced (no strict page limits) and contain the following:

1. The names of all group members (*Please nominate 1 group member to be the contact person for the project. This person will receive and share with the group any feedback and can help the course coordinator and technical staff with questions about the materials list (below)).
2. A 2-3-paragraph introduction explaining the conceptual background and motivation for the research project, including 3-6 citations of primary literature.
3. A clear statement of aims, objectives, hypotheses and/or predictions.
4. Proposed methods (future tense), including an initial overview that describes how the methods meet the objective(s) followed by detailed methodologies.
5. A graphical/pictorial presentation of the methods. For example, this may be a diagram of an experimental design, a diagram of a sampling regime, or a timeline.
6. Identify 2 potential challenges/issues you could run into with your project in the field and nominate a response strategy or 'Plan B' to ensure you get data.

Assessment criteria
Background logically and concisely summarized
Aims/objectives clearly stated
Methods presented in a logical and easy-to-follow manner
Information communicated through graphical/pictorial presentation
Clear identification of challenges and plausible solutions
Clarity in expression; correct grammar, spelling and punctuation

Learning Objectives:

- Practice writing and communication skills
- Enhance familiarity with literature search engines
- Practice synthesis of concepts
- Practice communication through graphical approaches
- Develop skills for designing research

Using the Web of Science

Web of Science is a great resource for finding peer-reviewed scientific papers. Go to the library website http://info.library.unsw.edu.au/ and click on "databases & e-journals" (under quicklinks). Click "find resource", and search for "web of science". Bookmark the Web of Science homepage for future use. To search, put your search terms in the top line. You can use AND, OR, and NOT to combine search terms. It is often necessary to use 'wildcard' terms to allow for plural uses of a word or words with alternate suffixes. For example, if you want to look for papers on climate change impact in lizards and snakes, you might search '(lizard* OR snake* OR squamat*) AND (climat*)'. Once you've found a relevant article, click on its title to see the abstract. If you want to read the whole paper, click on the SFX button. This gives you links to the full text in pdf format (as long as our library subscribes to the journal in question). A way to find other potentially useful papers is to look at the papers cited in a relevant paper, or the papers that have cited this paper since it's been published: just click on the blue, underlined numbers next to "times cited" or "references".

References

Please use the referencing style of a major journal such as *Ecology* or *Austral Ecology*. References should be cited within the text by name and date when first discussed. If there are two authors, include both names. For three authors, name the first author naming both authors where there are two authors, eg: (Veritas and Aziz 1998), or naming the first author followed by *"et al.".* An alphabetical Reference List should be included at the end of the research proposal. Web sites and popular science books are not appropriate references.

13.4 Datasheet and Materials list (group)

Datasheet (pdf): As part of designing the overall group research project, each student group will design a datasheet to use in the field. These datasheets should anticipate the quantity, type and frequency of data collection. **A good datasheet prompts the user to collect all of the necessary data.** Data sheets may be busy data tables with a single row for each object sampled and columns for the data collected on that object. A datasheet like this may allow 30 objects to be sampled on a single sheet. Alternatively, datasheets can have a lot of open space with a single object sampled per datasheet. Depending on your project, you may need more than one type of datasheet.

Materials list (excel): Each group must also provide a list of equipment and materials needed to complete the research. Each group is responsible for bringing their own basic materials: clipboard, pens/pencils, printed datasheets, gloves, etc.

The datasheet and materials list will be submitted with the Proposal.

Tips:

1. Always have 1-sided datasheets in case you change your project in the field and need blank paper.
2. Include a column or section for 'comments', so you can include observations you didn't plan for.
3. Always include space to collect general data such as date, time, general location, weather, etc.

Learning Objectives:

- Develop skills for designing research

13.5 Field Reflection (independent)

Immediately following the field-based research project, students will submit a Reflection on their experiences via Moodle. A series of questions on the research and field experiences will be provided. Students should provide their personal opinions and feelings about these experiences.

Learning Objectives:

- Enhance critical thinking
- Develop research skills through hindsight
- Develop insight into personal attributes, strengths and weaknesses

13.6 Draft figures (independent)

Following completion of data collection, each student must independently generate a publication-style graphical presentation of their main data. Students may discuss the importance and implications of their data with their group mates, but the figures must be generated individually.

1. The figure must present data collected on the field trip; the data can be raw (e.g. scatter plot) or summarized (e.g. bar graphs presenting means)
2. Create a figure that conveys the important finding of the results
3. Try different visual approaches to increase the clarity in the figure (e.g. should a bar plot be 'grouped'?)
4. The figure can include up to 2 panels
5. A caption (aka 'legend') describing the figure must be included
6. You can use whatever software program you choose, but I suggest avoiding the default settings of Excel

Figures will be submitted via Moodle. The 3-4 figures submitted for each group will compete against each other in a class vote for best group figure. The winner within each group will get 1 percentage point extra credit on their final report, up to the maximum report score.

Learning Objectives:
- Develop graph-making skills
- Practice communication through graphical approaches

13.7 Peer Review of draft figures (independent)

Following draft figure submission, each student will be assigned (via Moodle) **two figures** from their peers. Students will provide constructive comments on the two figures to assist their peer improve the figure.

Learning Objectives:
- Enhance critical thinking
- Improve graph interpretation and graph-making skills through critique
- Practice peer critique

13.8 Project presentation (group)

Each group will give a **10-minute** powerpoint presentation on their research project. The presentation should include conceptual background/motivation, objectives of the research, graphical presentation of the results (including clear verbal explanation of the graph), and discussion of the results. Each student in the group must speak.

Learning Objectives:

- Enhance critical thinking
- Practice presentation skills
- Practice graph explanation
- Practice science communication

13.9 Project Report (independent)

A final report (5-6 pages, excluding references) on the research project is due in the last week of term. The report must be prepared independently by each student, but can use text written by the group in the Proposal (subject to improvement). Include the following sections:

1. A 2-3-paragraph introduction explaining the conceptual background and motivation for the research project, including at least 6 citations of primary literature. **Here, each student may use the text from the Proposal, but has to expand on that text individually.**
2. A clear statement of aims, objectives, hypotheses and/or predictions.
3. Methods in past tense, including an initial overview that describes how the methods meet the objective(s) followed by detailed methodologies. **This section may be modified from the Proposal.**
4. A graphical/pictorial presentation of the methods. **This can be copied from the Proposal if unchanged.**
5. Written results of data collected, detailing the major findings, and including statistical summaries and tests (where appropriate). A table of results may also be appropriate. **This must be written independently by each student.**
6. At least one graphical presentation of the data. **This must be completed independently by each student. Please do not share figures with your teammates.**
7. A discussion summarizing your results and discussing them within the context of what is known in the scientific literature. **This must be completed independently by each student.**
8. References Cited.

Assessment criteria
Background logically and concisely summarized, Aims/objectives clearly stated;
Appropriate presentation of data and use of statistics; Methods communicated through graphical/pictorial presentation;
Results figure(s) convey information clearly and are professional looking;
Synthesis and critical interpretation of results wrt the literature;
Methods and results in logical format; correct grammar, spelling and punctuation;
Clarity in expression; well-structured paragraphs

Learning Objectives:

- Practice writing and communication skills
- Enhance familiarity with literature search engines
- Practice synthesis of concepts
- Practice communication through graphical approaches
- Improve critical thinking and data interpretation

14. Administration Matters

Expectations of Students	http://www.bees.unsw.edu.au/current/ugradguidelines.html		
Assignment Submissions	Unless otherwise advised, assignments must be submitted through the BEES student office (see http://www.bees.unsw.edu.au/current/studentoffice.html), fulfilling the conditions of the BEES Assignment cover sheet (see http://www.bees.unsw.edu.au/school/docs/assignmentcover.doc) which must be attached. The BEES assignment cover sheet lists penalties for late submission. For further information about the school see http://www.bees.unsw.edu.au/		
Occupational Health and Safety[6]	For information on relevant Occupational Health and Safety policies and expectations at UNSW see www.riskman.unsw.edu.au/ohs/ohs.shtml and for BEES specific requirements see http://www.bees.unsw.edu.au/ohs/indexohs.html.		
Assessment Procedures	If illness or misadventure intervenes to prevent a student meeting an assessment deadline or class meeting then he/she should contact the lecturer in charge of the assessment. The conditions for special consideration are given at Http://www.bees.unsw.edu.au/current/ugradguidelines.html.		
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 www.equity.unsw.edu.au/disabil.html). 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 found at: www.secretariat.unsw.edu.au/acboardcom/minutes/coe/disabilityguidelines.pdf		
Grievance Policy[7]	**School Contact**	**Faculty Contact**	**University Contact**
	Dr Jes Sammut j.sammut@unsw.edu.au ph: 9385 8281	A/Prof Julian Cox Associate Dean (Education) julian.cox@unsw.edu.au Tel: 9385 6063 or Dr S Mooney Associate Dean (Undergraduate Programs) s.mooney@unsw.edu.au Tel: 9385 8063	Graduate Research School Tel: 9385 2969 Compass University Counselling Services[8] Tel: 9385 5418

[6] UNSW Occupational Health and Safety: www.riskman.unsw.edu.au/ohs/ohs.shtml
[7] UNSW Grievance Policy: http://www.infonet.unsw.edu.au/poldoc/student_grievance_resolution.pdf
[8] Compass – University Counselling Service http://www.counselling.unsw.edu.au/compass_programs/