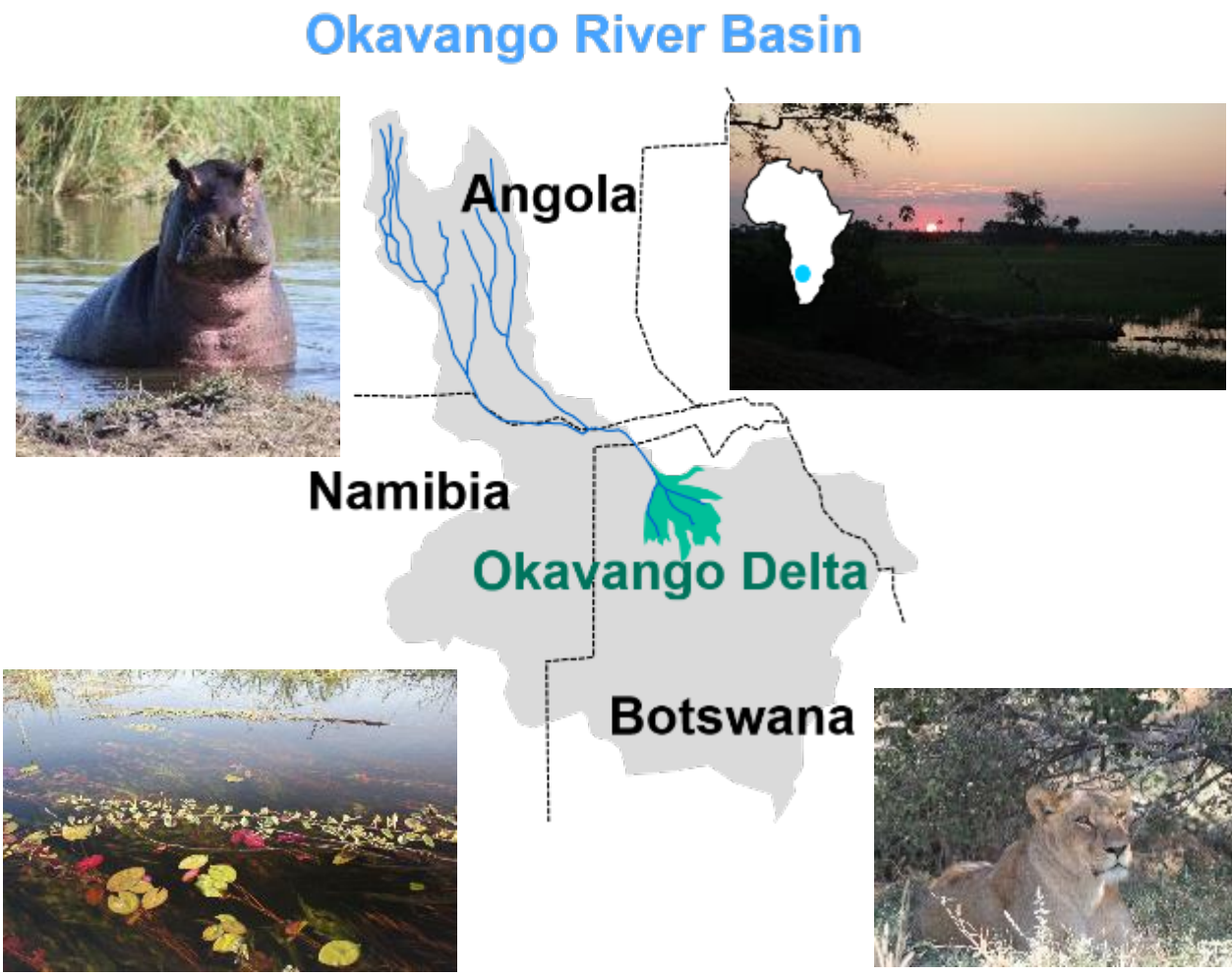
FACULTY OF SCIENCE

School of Biological, Earth and Environmental Sciences

BIOS 6723

River Basin Ecosystem Management

Field Course Manual
Session 2, 2019



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1. Information about the Course (BIOS6123)

NB: Some of this information is available on the UNSW Virtual Handbook[1]

Year of Delivery	*20167*
Course Code	*BIOS 6723*
Course Name	*River Basin Ecosystem Management*
Academic Unit	*School of Biological, Earth and Environmental Sciences*
Level of Course	*3rd Year*
Units of Credit	*3*
Session(s) Offered	*Session 1*
Assumed Knowledge, Prerequisites or Co-requisites	Prerequisites: 1 of 3: BIOS1101 (Evolution &Functional Biology), BIOS1301 (Ecology, Sustainability & Environmental Science), BIOS2123 (River Ecosystem Conservation and Management); BEES2041 (Data Analysis for Life and Earth Sciences).
Hours per Week	*49hrs, 70hrs in total (7hrs a day)*
Number of Days/Weeks	*10 days*
Commencement Date	29 June 2019

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

Component	Hours	Time	Day	Location
Lectures	***10***			***Field***
Fieldwork	***120***			***Field***
Group project	***20***			***Field***
TOTAL	**150**			
Special Details	• A field trip is run in of the break before Semester 2. Estimated cost of field trip, including accommodation and catering will be approximately $1,800 payable in advance. All costs are included. • A workshop for final presentations will be held on Day 9-10.			

University policy requires students to attend at least 80% of lectures and labs in order to quality 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.

2. Staff Involved in the Course

Staff	Role	Name	Contact Details	Consultation Times
Course Convenors (UNSW)		Richard Kingsford Neil Jordan Keith Leggett	richard.kingsford@unsw.edu.au neil.jordan@unsw.edu.au k.leggett@unsw.edu.au	By appointment
Additional Teaching Staff	Lecturers & Demonstrators (Kings College London/Arizona State University)	Mike Chadwick Dave White Claire McWilliams Jane Catford	michael.chadwick@kcl.ac.uk dave.white@asu.edu claire.mcwilliams@asu.edu.au jane.catford@kcl.ac.uk	By appointment
	Technical & Laboratory Staff	Tempe Adams	tempe@unsw.edu.au	By appointment
	Other Support Staff	Victoria Inman	victoria.inman@student.unsw.edu.au	By appointment

[1] UNSW Virtual Handbook: http://www.handbook.unsw.edu.au/2012/index.html

3. Field Trip Teaching Staff

Professor Richard Kingsford (Course Convener)
I am a conservation biologist, working in river basin management and conservation. I am particularly interested in the effects of river flows on wetland ecology, waterbirds and long-term sustainability of rivers. I have also worked on adaptive management of river basins and am involved in a number of advisory committees for governments in Australia. I am also part of the Lake Eyre Basin Partnership which has an agreement with the Okavango River Basin Commission to learn about different models of river management.

Dr Neil Jordan
I have a joint position between UNSW and the Taronga Conservation Society Australia, and broad research interests across the field of applied animal behaviour. From meerkats to wild dogs, behavioural ecology to conservation management, much of my work has focused on scent communication in wild carnivores. My current focus in applying behavioural ecology to conservation management, particularly in understanding and resolving human-wildlife conflicts.

Dr Keith Leggett (Director of Fowlers Gap Research Station)
In 2009, after 20 years in Africa, I became the Director of Fowlers Gap Arid Zone Research Station, a field station of UNSW. Throughout most of my research career I have studied large mammals in Southern Africa, including studies on elephant, cheetah and lions. My current field of study looks at the seasonal and annual fluctuations in small mammal populations in response to climatic conditions. I currently have 2 PhD students studying in Botswana, one studying giraffe and the other hippos.

Dr Michael Chadwick (Department of Geography, King's College London). I have been working in stream ecology for over 20 years with a main research objective to understand how both anthropogenic and natural stressors influence aquatic systems. This work has been conducted in a range of locations in the USA, UK, India and Borneo. Most of this work involves studying aquatic macroinvertebrates & fish.

Dr Jane Catford (Department of Geography, King's College London).
I am a plant ecologist interested in interactions between vegetation and global environmental change. I focus on biological invasions and how exotic plant invasions can be both a symptom and cause of environmental change, including hydrological change. I combine theory with empirical and quantitative approaches to increase fundamental understanding of ecological processes, for ecological policy and management. I have worked in freshwater and terrestrial ecosystems in Australia, US, UK and China, mostly focusing on wetlands, rivers and grasslands.

Professor Dave White (School of Community Resources and Development Arizona State University), is the Director of the Decision Center for a Desert City, and Senior Sustainability Scientist in the Julie Ann Wrigley Global Institute of Sustainability. He is internationally-recognized for his contributions to science in support of sustainable development. He has published scientific journal articles advancing numerous fields including decision science, science and technology studies, sustainability science, and natural resources management.

Dr Claire McWilliams (School of Community Resources and Development Arizona State University), is a tourism development and management and hospitality instructor in the School of Community Resources and Development at Arizona State University. She has a bachelor's degree in hotel and restaurant management and a master's degree in educational. She has a doctorate with an emphasis in industrial and organizational psychology from Grand Canyon University. Her research focused on the psychological impact of exposure to negative customer behavior on frontline customer service providers in the hospitality/tourism industry.

4. Course Details

Course Description[2]	This course is an intensive field-based course located in Botswana's Okavango Delta, one of the world's hotspots of biodiversity and a UNESCO World Heritage site. It has extensive wetland systems with diverse waterbird populations, vegetation communities, the largest population of elephants in Africa and large predators, including lions and leopards. This diverse ecosystem lies at the end of one of the world's last few large free-flowing rivers. This course will involve non-government and government managers involved in practical concepts of river basin ecosystem conservation, management and governance. This course covers human and social dimensions of ecosystem conservation such as community based natural resource management (CBNRM) sustainable tourism, and community livelihoods. Students will acquire an advanced understanding of the politics, governance and management of river basin ecosystem science, by unpacking the geopolitical constraints and considerations shaping the Delta's management. It receives most of its water from Angola with the Okavango River then flowing through Namibia to Botswana. Participants will gain skills in field methods, ecosystem scale landscape analyses and their application to human/wildlife interactions. They will contribute to long-term collection of data for the management of the river basin. The overall aim of the course is to tackle a global challenge in a developing country of the world, focusing on sustainability of biological and abiotic processes within the context of human drivers of development. It uses the Okavango River Delta as a case study but compares this to Australian systems, particularly the Lake Eyre Basin. In addition the course will encourage a holistic view of river basin ecosystem management by covering, hands-on, the challenges associated with an international approach to ecosystem conservation management. It will include the roles played and challenges faced by governments and communities catchment-wide. Students will work directly with UNSW academics and industry partners from NGOs, local government. This co-operative learning approach between UNSW, university partners, non-government partners and government itself places UNSW at the forefront of river basin ecosystem management and education, and provides insight into the multi-faceted approach that river basin conservation requires. This course allows students to gain invaluable experience and course credit in real-life conservation contexts and provides contacts for future higher-degree learning opportunities (i.e. Honours or PhD programs). The course also aims to provide a social dividend through the inclusion of Botswana students from the University of Botswana. It is also part of the PLuS Alliance http://www.plusalliance.org/ involving UNSW, Kings College London and Arizona State University.
Course Aims[3]	The course will offer a globally unique opportunity to expose PLuS Alliance students to international and cross-border issues associated with ecosystem conservation and management. This course has been specifically designed to address a need in the School of BEES relating to Program 3965 Environmental Management: this is the second course that specifically focuses on environmental management. The aims of BIOS6723 "*River Basin Ecosystem Management*" are: 1) To provide students with the opportunity for advanced training in river basin conservation and management using case studies from Africa, Australia and United States; 2) To consider the political, governance and management scale and constraints of river basin conservation management, and learn directly about these challenges in Botswana; 3) To gain practical international experience in river basin ecosystem monitoring including the implementation of survey techniques on wetlands and their directly dependent (i.e. aquatic biota) and indirectly dependent (terrestrial animals that require water, e.g. elephants), and recognise the challenges of environmental flow management; 4) To understand the data and scale requirements for modeling large river basin ecosystems, identifying dependent ecosystem values and services; 5) Provide an understanding of the role and complexity of collaborative approaches to river basin ecosystem conservation and management through the development of an adaptive river basin management plan, built on a hierarchy of values, which identifies the management objectives, key stakeholders and response indicators.
Student Learning Outcomes[4]	By the end of this course, students will have acquired enough applied practical skills in river basin management to: • To apply acquired knowledge to practical challenges in this field. • Developing a river basin ecological monitoring plan. • A clear understanding of river basin ecosystem science by completing field-based tasks including conducting field surveys of river basin ecosystem indicator species. • Academically taught concepts to actual conservation management strategies.

[2] UNSW Virtual Handbook: http://www.handbook.unsw.edu.au/2012/index.html
[3] Learning and Teaching Unit: http://www.ltu.unsw.edu.au
[4] Learning and Teaching Unit – Learning Outcomes: http://www.ltu.unsw.edu.au/content/course_prog_support/outcomes.cfm?ss=0

Graduate Attributes Developed in this Course[5]		
Science Graduate Attributes[5]	*0 = NO FOCUS* *1 = MINIMAL* *2 = MINOR* *3 = MAJOR*	**Activities / Assessment**
Research, inquiry and analytical thinking abilities	3	• Data sheets • Presentations • Report including Figures & Critique • Research Report
Capability and motivation for intellectual development	3	• Research proposal • Paper discussions • Report including Figures & Critique • Presentation and engagement
Ethical, social and professional understanding	1	• Interaction with local community • Research Report • Discussion topics
Communication	3	• Research proposal • Presentations • Reports including Figures & Critique • Research Report
Teamwork, collaborative and management skills	2	• Research proposal • Data sheets • Presentations • Research Report
Information literacy	2	• Research proposal • Paper discussions • Report including Figures & Critique • Research Report

Major Topics (Syllabus Outline)	(1) Demonstrate an understanding of the current river basin management practices, as large social-ecological systems, role of science and conservation challenges, including governance and involvement of stakeholders,. (2) Demonstrate an ability to identify the relevant stakeholders in river basin management, and an understanding of the impacts that different management strategies may have on stakeholders and ecosystems. (3) Demonstrate an understanding of the importance and challenges of a collaborative international (or interstate) approach to river basin conservation and management in terms of governance, policy and management. (4) Demonstrate proficiency in ecosystem indicator species survey methods via practical assessment. (5) Collaborate with colleagues to collect and interpret primary biophysical data that would allow you to make inferences regarding the health of a river basin ecosystem. (6) Demonstrate an ability to work collaboratively and productively in groups. (7) Demonstrate an understanding of the limitations on our capacity to implement appropriate river basin management programs. (8) Demonstrate an ability to incorporate monitoring of flow and ecosystem indicator species into river basin management. (9) Demonstrate an understanding of the ecosystem concept and identification of ecosystem services and role of the flood pulse. (10) Demonstrate use of reflective practices regarding the processes and experiences that occur during this course and where they fit in relation to other experiences or the 'big picture', and to demonstrate the capacity to acknowledge and express of how these experiences make you feel: facilitating growth as a reflective practitioner. (11) Develop skills using technical research equipment and appropriate methods.
Relationship to Other Courses within the Program	This course is an intensive field-based course which is run in conjunction with in-country collaborators through MOUs with UNSW and involves UNSW partners in the Plus Alliance: Arizona State University (ASU) and Kings College London. Note that this course is synced with ASU course: CRD 494/598 Topic: Botswana: Intersection of Water, Ecosystems & Government. In particular, the course would form part of the River Basin focus, under Environmental Sustainability and Global Connected River Basins, already developed as a key element of the Plus Alliance partnership. The course focuses on the conservation and management of river basins, and has relevance internationally and within Australia. Students will gain skills in surveying methods, and practical training will include development of a river basin management plan which takes into account the complex geopolitical landscapes under which such plans must be drafted and undertaken. It is intended for 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. BIOS1101 (Evolution &Functional Biology),

[5] Access the Science Graduate Attributes and your mapped courses: http://www2.science.unsw.edu.au/guide/slatig/sciga.html
(Mapped courses are available at this site)

	BIOS1301 (Ecology, Sustainability & Environmental Science), BIOS2123 (River Ecosystem Conservation and Management); BEES2041 (Data Analysis for Life and Earth Sciences).

5. Rationale for the inclusion of content and teaching approach

Rationale for learning and teaching in this course[6],	In recent years, there have been too few places available to offer all undergraduate students the experience of longer, more intensive field work situations, under unique and challenging working and learning conditions, which expose them to realities and practicalities of environmental management. UNSW is in a unique position in having long-term relationships with Botswana non-government organisations and a strong track record in ecosystem research and management. This course fills that gap and proceeds and complements a second year elective course BIOS2123, which includes aspects of river ecosystem conservation and management in Australia. The course is supported by the Centre for Ecosystem Science, one of the four major centres in the School of Biological, Earth and Environmental Sciences. It has a strong applied ecology and environmental science focus. BIOS6123 will teach applied practical skills required in river basin management, policy and governance as well as asking students to apply acquired knowledge to a practical challenges in this field and governance challenges for managing large river basins. These include developing a river basin ecological monitoring plan. Students will also acquire a clear understanding of river basin ecosystem science, governance and management by completing field-based tasks including conducting field surveys of river basin ecosystem indicator species. This course allows students to apply academically taught concepts to actual conservation management strategies and will produce well-rounded, industry-ready graduates. The field work component of BIOS6123 will be held out of session, before the beginning of Semester 2. Furthermore, the majority of this course is taught during the intensive field course and on-line, with assessment. This will alleviate pressures on university resources and students during peak periods in semester.

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

6. Teaching Strategies

Teaching Strategies	Lectures will present and discuss theoretical issues relevant to course content. They will draw on real examples from river basin management programmes and will include reference to examples of current research. Lectures will be given during the field course with particular focus applied to the Cubango-Okavango catchment, with parallels being drawn with the Lake Eyre and Murray-Darling Basins in Australia and the Everglades, Colorado River and other international rivers. Conservation practitioners, particularly from local non-government organisations such as OKACOM (Okavango River Basin Commission), Government Departments, USAID, Elephants Without Borders, and scientists from the Okavango Research Institute of the University of Botswana, will present lectures relevant to these aspects of the course. Practical exercises and formative assessments will require the active use and application of critical thinking skills in a variety of contexts. These activities will be developing skills in research and survey techniques; use of appropriate techniques and variables; management plan writing; understanding of governance and adaptive management frameworks and team work. Written assessments will allow students to demonstrate information research skills and application of their critical and analytical skills and integrative thinking. This field based course is designed to provide students with the opportunity to learn from academic and industry professionals about the challenges and opportunities presented by the conservation management of an internationally important river basin whose catchment spans three countries. It is designed to demonstrate excellence in international education, providing a distinctive educational experience. It also involves partnering with many different institutions working on a large scale grand challenge of global importance – water management in the Cubango-Okavango River Basin. It also incorporates elements of social engagement, through the provision of placements for local Batswana students. The course is designed to allow reflection and development of critical and practical thinking in the design and planning of river basin management. It aims to stimulate students to consider a holistic approach, including the importance of identifying and engaging diverse stakeholders. It also aims to provide practical skills in survey techniques and subsequent analyses.

7. UNSW Academic Honesty and Plagiarism Policy (Please note that ASU students should refer to Canvas (our web platform) for ASU-specific policies and procedures)

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.

8. 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)

	Date(s)	Activity	Content	Assessment Tasks	Notes
	29th June 2019	**Students make arrangement to arrive in Maun, Botswana by this date (aircraft usually arrive after lunch; accommodation will be organized from the 10-20th inclusive)**	am • Pick up from airport and travel to Sitatunga Rest Camp- http://www.deltarain.com/sitatunga-camp-2/ settling up camp pm • Introductions + Work, Health and Safety Briefing, Site orientation, Logistics Briefings • Short talks from each student (allocated beforehand) • Split students into three groups	Short talks	Sleeping bags, pillows and toiletries (including towel) will be needed
	30th June 2019	**Orientation work at Sitatunga Rest Camp-** http://www.deltarain.com/sitatunga-camp-2/	am • River Walk – bird and animal identification, resource use (2-3hrs), • Student 3-minute talks continued (2-2.5hrs), am - Lectures • Dr Mike Murray-Hudson - Introduction to Okavango Delta; • Professor Dave White - Theory and concepts of (Integrated) Water Resources Management; • Dr Neil Jordan - Experimental design and principles of surveys, Okavango surveys • Group activity: Design of field sampling for different activities (rivers, river/ terrestrial interface, terrestrial (diurnal and nocturnal). Standardised relative to previous years data collection.	Data collection underpins the main project of designing the basin Environmental flow monitoring plan	Bird books, discussion of sampling waterbirds and other animals Question and Answer after lecture Resources provided will include maps and identification resources. The aim of this exercise is to build on the long-term surveys which allow testing effects of variability of changing flooding regimes and terrestrial ecosystems over time in relation to natural and/ or anthropogenic impacts
	1st July 2019	**Field Camp**	am • Fly into Camp in the Okavango River Delta (about 30 mins) (19º25'30.86'S, 22º35'21.83) from Maun pm		Design of field sampling for different activities (rivers, river/ terrestrial interface, terrestrial (diurnal and nocturnal)

			• On site orientation and Work, Health and Safety talk on Okavango Delta Field Camp • Data sets including GIS, flow data, animal survey data GPS • Set up Camera traps • Professor Richard Kingsford – Managing the Okavango River Basin		
	2th July 2019	**Field Camp**	am • Terrestrial environment (surveying tracks, birds and vegetation), and (habitat types) – testing of survey methodology • River environment (boat survey) – birds, mammals, habitats, water quality, fish, extent of inundation, testing of methodology (habitat types, functional response groups,) • Riparian environment (vehicle survey) – land/ water interface, birds and mammals, interactions between land and water – habitat types, functional response groups, testing of methodology Lunch time Lecture - Dr Michael Chadwick - limnology and the life of invertebrates in the Okavango Delta • Project work, including data analyses (13:00-17:00) pm Lecture Dr Neil Jordan – Human wildlife conflicts in the Okavango Delta • Nocturnal survey – diversity/ abundance and survey methodology (habitats, functional response groups, bias)	Also each group will be assigned an aspect of the social-ecological system for integration of flows, flooding and resource pulses Data collection will also underpin the main project of designing the basin environmental flow monitoring plan	Each group will separately do one of the activities on each morning of the field camp.
	3th July 2019	**Field Camp**	am • Terrestrial environment (surveying tracks, birds and vegetation), and (habitat types) – testing of survey methodology • River environment (boat survey) – birds, mammals, habitats, water quality, fish,	Also each group will be assigned an aspect of the social-ecological system for integration of flows, flooding and resource pulses	Each group will separately do one of the activities on each morning of the field camp.

			extent of inundation, testing of methodology (habitat types, functional response groups,) • River environment (vehicle survey) – land/ water interface, birds and mammals, interactions between land and water – habitat types, functional response groups, testing of methodology Lunch time lecture –Dr Claire McWilliams – Sustainable tourism • Project work (13:00-17:00) pm Lecture Keith Leggett (Elephant Research/Community Based Natural Resource Management Programmes) • Nocturnal survey – diversity/ abundance and survey methodology (habitats, functional response groups, bias)	Data collection will also underpin the main project of designing the basin environmental flow monitoring plan	
	4th July 2019	**Field Camp**	am • Terrestrial environment (surveying tracks, birds and vegetation), and (habitat types) – testing of survey methodology • River environment (boat survey) – birds, mammals, habitats, water quality, fish • River environment (vehicle survey) – land/ water interface, birds and mammals, interactions between land and water Lunch time lecture –Richard Kingsford – River regulation – meaning and impacts / Mike Chadwick – food webs of rivers • Project work, data organisation, Designing Integrated Water Resources Management strategy for the Okavango basin • (13:00-17:00) pm • Nocturnal survey – diversity/ abundance and survey methodology (habitats, functional response groups,	Also each group will be assigned an aspect of the social-ecological system for integration of flows, flooding and resource pulses Data collection will also underpin the main project of designing the basin environmental flow monitoring plan	Each group will separately do one of the activities on each morning of the field camp.

			bias)Nocturnal survey – diversity/ abundance		
	5th July 2019	**Field Camp**	am • Terrestrial environment (surveying tracks, birds and vegetation), and (habitat types) – testing of survey methodology • River environment (boat survey) – birds, mammals, habitats, water quality, fish • River environment (vehicle survey) – land/ water interface, birds and mammals, interactions between land and water Lunch time lectures – Dr Tempe Adams - Human and Elephant conflict Dr Jane Catford – Environmental changes through the lens of aquatic plants • Project work (13:00-17:00) pm • Nocturnal survey – diversity/ abundance and survey methodology (habitats, functional response groups, bias)Nocturnal survey – diversity/ abundance	Also each group will be assigned an aspect of the social-ecological system for integration of flows, flooding and resource pulses Data collection will also underpin the main project of designing the basin environmental flow monitoring plan	Each group will separately do one of the activities on each morning of the field camp.
	6th July 2019	**Presentations and review of field studies at Audi Rest Camp**	am • Flying back from Field Camp • Stay at Audi Camp- http://www.audisafaris.com/audi-camps/ • Site orientation pm **Project results compared to 2017 and 2018** • River surveys • Terrestrial surveys • Riparian surveys		Design of field sampling techniques for different activities
	7th July 2019	**Social Science**	am • Field Trip • Professor Thakadu, University of Botswana – Cubango-Okavango Basin Natural Resource Management	• Either river walk or trip to game reserve • Potential student-led focus group discussion with local stakeholders	

			pm • Analysis of data • Discussion of data and its implications	about river basin ecosystem management and community issues. • Group exercise to assess the data and the implications for the management of the Okavango River Basin (Botswana perspective)	
	8th July 2019	**Presentations and review of field studies at Audi Rest Camp**	am • River walk • 2 x Group Presentation of projects pm • afternoon in Maun	• River management (Present data and explain how it could be used in an adaptive management framework) • Present sociological data and discuss its implications • Habitat analysis using GIS - delta populations • Reflective exercise • Group exercise – management of a habitat, including social, economic and environmental dimensions (Maun at end of trip)	Individuals will be called upon to present different perspectives on river basin forum in an open debate
	9th July 2019	**Maun**	am • Free time 2:00pm - Fly out		

10. Additional Resources and Support

Text Books	**Recommended texts (bookshop and UNSW library):** Lanting, F. (1993). *Okavango Africa's Last Eden*. (Taschen Publishing, Franfurt) Pickford, P. & Pickford, B. (1999). The Miracle Rivers: the Okavango & Chobe of Botswana. Southern Book Publishers, Johannesburg, South Africa. Skinner, J.D. & Smithers, H.N., (1990) The mammals of the Southern Africa Sub-region. University of Pretoria, Pretoria, South Africa. Coates-Palgrave, K. (1983). Trees of Southern Africa, Struik Publishers, Cape Town South Africa. Ellery, K & Ellery, W. (1997), Plants of the Okavango Delta: A Field Guide. Tsaro Publishers, Durban, South Africa. Newman, K. (1988). Newman's Birds of Southern Africa. Southern Book Publishers, Johannesburg, South Africa.
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	Okavango River Institute (University of Botswana) – http://www.ub.bw/home/ac/1/fac/8/dep/9/Okavango-Research-Institute/ Elephants Without Borders - http://elephantswithoutborders.org/ Okavango River Basin Commission - http://www.okacom.org/

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	2021	Major revision of the course will occur within two years of running the course.
CATEI[7]	2019	Student comments on CATEI evaluations will contribute to course revisions, along with other comments provided verbally and in writing throughout the course.
More/Less/Start	2017-2021	During course term, students can submit anonymous requests for 'more' or 'less' of any content, as well as request a 'start' of content not available.
Other	2017-2021	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?

[7] Science CATEI procedure: http://www2.science.unsw.edu.au/guide/slatig/catei.html

12. Field Course

Location: **Sitatunga Rest Camp, Maun, Botswana**
Elephants Without Borders Field Camp, Okavango Delta, Botswana
Audi Rest Camp, Maun, Botswana

12.1 Background

This field based course is designed to provide students with the opportunity to learn from academic, government and industry professionals about the challenges and opportunities presented by the conservation management of an internationally important river basin whose catchment spans three countries. It is designed to demonstrate excellence in international education, providing a distinctive educational experience. It also involves partnering with many different institutions working on a large scale grand challenge of global importance – water management in the Cubango-Okavango River Basin.

The course is designed to allow reflection and development of critical and practical thinking in the design and planning of river basin management. It also aims to expose students to the governance, policy and management challenges of large river basins, understanding these as large social-ecological systems with stakeholders and complex interactions with ecosystems. It aims to stimulate students to consider a holistic approach, including the importance of identifying and engaging diverse stakeholders. It also aims to provide a practical introduction to some survey techniques.

12.2 Overview

WHERE: Maun, Okavango Delta, Botswana

WHEN: 29th June – 8th July
Meet-up: Maun Airport,
Drop off: Maun Airport,

GETTING THERE:
Students will need to arrange their travel to Maun in Botswana. Usually this will involve purchasing a return flight through Johannesburg in South Africa. All transport including flights into the Field Camp will leave from Maun Airport. First and last few days of accommodation will be at the University of Botswana's Okavango Research Institute in Maun. The main part of the course in the middle will be at the field camp in NG26, western side of the Okavango Delta.

Recommended travel options to Maun, Botswana:
***** Book these options early as they will get more expensive the longer they are left. All accommodation will be booked in country for students.**

Flights
Sydney to Johannesburg
Departs: Sydney, (Qantas, 6 flights a week, leaving 11:50), 14 hour flight
Arrives: Johannesburg (South Africa), (arrives 17:30)

This flight arrives too late to catch a flight to Maun in Botswana. There are several nice hotels (~$100 a night) close to the airport that can be booked from Australia though most do not require bookings.

Flight
Johannesburg to Maun
Departs: Johannesburg (South Africa)
Arrives: Maun (Botswana), (3 flights a day; South African Airlines, 10:25, 11:45; Air Botswana,11:10) ~2 hour flight

Total return flight to Maun – ~$2500 return

Flight
Maun to Field Camp (return)
Departs: Maun (Botswana) – by negotiation
Arrives: Field Camp (Okavango Delta, Botswana), (by negotiation) ~30mins flight

Economy – $440 return

Additional Costs: We estimate that on top of airfares an additional $1360 dollars will be necessary to cover food, accommodation, equipment and transport.

Travel insurance: Covered as with normal UNSW Field Work Courses. Though any additional travel will be needed to be covered by the individuals insurance.

12.3 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. Wind Jacket 6. Sunblock 7. Insect repellent 8. Water bottle 9. Thin leather gloves 10. Head torch 11. Swimmers (optional) 12. Field notebook 13. Datasheets, pencils, clipboard 14. Personal medication and toiletries 15. Laptop for data entry (optional) 16. Binoculars and camera (optional) ***** Please bring your own sleeping bags and travel towel, these may not be needed but it is recommended that students bring their own.** **Note: Malaria transmission is known to occur in Botswana (https://wwwnc.cdc.gov/travel/yellowbook/2016/infectious-diseases-related-to-travel/yellow-fever-malaria-information-by-country/botswana) but is considered low risk. The course is taking place during winter with few mosquitos present, though long pants and long sleeved shirts are recommended after dark.**
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.

12.4 Research Station Amenities

Accommodation: Rustic facilities, beds and bunks; flush toilets and showers; limited electricity; drinking water; eating utensils. You will need to bring your own sleeping bag and travel towel.

Other resources: In Maun, limited internet and mobile phone access, in field camp there is no internet or phone facilities and limited laboratory facilities.

13. Assessment details

Assessment Summary.

Task	% of Total Mark	Due Date	How to Submit
13.1. Organisms, processes and people of the Okavango River basin (Individual presentations)	10	First 3 days	Assessment – involving individual 3 minute talks
13.2. River basin environmental management plan (Individual)	50	4 weeks after the completion of course	Moodle
13.3. Design and completion of field surveys of river basin ecosystem indicator species (group)	30	End of course	Continuous Assessment
13.4. Field Trip skills (independent)	10	End of course	0.5-1hr test

13.1 Organisms, process and people in the Okavango River Basin (Individual)

To be nominated before arrival in Botswana and consists of a 3 minute presentation in the first 3 days of the course on any topic associated with the ecological, socioeconomic or governance of the Okavango River Basin. The topic chosen must reflect the current situation in the basin management area. Some suggested topics of discussion would be (please nominate one topic before arriving in Botswana), You will need to email your topic to k.leggett@unsw.edu.au so that we can ensure only one topic per person :

- Why is river flooding important? And how does the flood regime of the Okavango vary from other rivers?
- What is unique about the Okavango River in terms of its flood timing and describe the morphology of the river system?
- What is unique about OKACOM? How does it function?
- How do reed mats form and what is the main plant species?
- How do the Real Fan Palm (*Hypheane petersania*) seeds spread and what is unique about them?
- Why are hippos regarded as ecosystem engineers?
- What is the ecological role of elephants?
- What is the ecological role of predators?
- What are some of the unique wildlife species in the Okavango River system?
- What bird species nest in the Okavango Delta and how many winter or summer visitors are there?
- How did the Herero People end up in Ngamiland?
- What is the dominant tribe in Botswana, who is their current leader and describe the transition from Colonial rule to independence and who was most responsible for this?
- What is the role of the Wildlife Management Areas (WMA's) in the conservation strategy of the Botswana Government?
- What are the positives and negatives of professional hunting and why was it banned in Botswana?
- Who owns wildlife?
- What is fortress conservation and does it work? What kinds of tradeoffs arise from developing a river like the Okavango?
- What are the 'wicked' features of the Okavango River basin?
- What are the current knowledge/data gaps in managing the Okavango River basin?

5% of total mark.

Learning Objectives:
- Practice communication skills
- Enhance critical thinking
- Increase comprehension of professional scientific and popular literature

13.2 River basin environmental management plan (individual)

Structure (1500 words, not including references).

1. Context (300 words)

This should describe catchment, source of water, human dependencies and include information about seasonality and the behaviour of the river and the wetland. The potential threats to the river ecosystem should also be identified.

2. Governance (200 words)

You should describe how the river basin is governed and managed in its different sections and overall.

3. Vision and goals for management (400 words)

You should describe the aim of environmental flow management is which underpins a vision for the basin. As well as a broad goal, you should derive more specific goals which may be related to human and environmental management which is also spatially explicit. Eventually this should lead to a description of what key aspects of the environment will be monitored. It must be clear that the low level objectives clearly link to the value lade vision and broad scale goals. Preferably, you should draw a hierarchy of objectives which link the broad scale vision to objectives to be measured.

4. Monitoring schedule (400 words)

You need to detail what indicators you will measure and how these are related to your goals. You should provide a rationale for sampling, both in terms of temporal frequency and spatial coverage. You also need to indicate the type of data you will collect and how you would likely analyse these data so that you could influence the management of the river basin. You should also consider thresholds of potential concern.

5. Reporting and outreach (200 words)

Specify how you would use the results of your environmental monitoring and how this would be reported. Importantly, there should be a clear articulation of how different environmental indicators are linked to management levers (agencies and actions).

Feedback will be given individually on each report, given no later than four weeks after submission.

50% of total mark.

Learning Objectives:

- Practice writing and communication skills
- Enhance critical thinking
- Practice interpretation of data skills
- Increase comprehension of professional scientific literature
- Enhance group cooperation skills
- Improve written presentation skills

13.3 River basin management and policy (group)

Students will be split into the three groups, representing the three major countries in the river basin (Angola, Botswana and Namibia). The aim of this assessment is to develop a group project focusing on river management and equity of water use examining the effects on people, aquatic, riparian dependent on the river and terrestrial organisms and processes. The groups will work on a project examining the potential effect of river flows, flooding and resource pulses in the delta, reliant on rainfall in Angola, Namibia and Botswana.

Groups will then consider potential effects of any water extraction on the river basin system in light of potential development upstream (irrigation, hydropower). Each group will give a presentation at the end of the course on one of the aspects allocated. The presentations should be about 30-40 minutes. They should consider the potential environmental impact of upstream developments on the entire Cubango-Okavango basin catchment. They will need to identify the suite of stakeholders both locally and internationally that may be concerned about the

effects of development on their particular aspect of the ecosystem as well as the need for poverty alleviation upstream, using water.

Key factors to consider for each of the particular parts of the ecosystem (people, aquatic organisms, terrestrial organisms):

- Potential cost and benefits to the particular part of the ecosystem that the group is measuring
- Potential impacts on the socio-economics of the system, including costs and benefits up and down the river system.
- Describe the effect on changing flooding regime on allocated parts of the ecosystem for your group (e.g. abundances, diversity).
- Identify potential indicator species and methods for tracking changes over time.

Group presentations will be marked and each person in the group will receive the mark for the group

25% of total mark.

Learning Objectives:
- Practice writing and communication skills
- Enhance analytical and critical thinking skills
- Practice synthesis of concepts
- Develop skills for designing research

13.4 Field surveys of river basin ecosystem indicator species (group)

This is a practical exercise, involving surveying particular ecosystem indicator species which will assist in management of the river basin. You will be introduced to field survey techniques and equipment in tutorial format, where you will take an active role in designing and conducting these surveys in small groups. You will be assessed on your engagement and practical skills throughout the planning and execution of these surveys

5% of total mark.

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

13.5 Reflective exercise (individual)

The benefits of many skills and experiences you gain from practical experience will not be immediately obvious, but will become apparent through reflection of the processes and experiences in which you are engaging during your study. Acknowledgement and expression of how you feel about these experiences and where they fit in relation to other experiences or the 'big picture' facilitates your growth as a reflective practitioner. The aims of this course include to provide practical training and to facilitate experience of current ecosystem conservation and management strategies. This reflective exercise is designed to assess less tangible aspects of your learning and to highlight the importance of reflection to obtain a complete conservation experience.
Please complete the following tasks:

a) in maximum of three paragraphs, describe your impressions of the current state of river basin management in Botswana and how you feel it should be approached;
b) In maximum of three paragraphs, describe how the lessons you have learned here could be applied to river basin management in Australia (or your home country if different);

c) briefly describe three important things you learnt about the constraints placed on river basin management strategies (and the organisations that implement them). Please rank these (with no.1 being the most important).Provide a brief justification why you ranked them in this order;
d) write one or two sentences each day describing the most outstanding thing you learnt that day;
e) write a paragraph describing the role of science in management of the river basin;
f) write a maximum of two paragraphs describing your practical experience during this field trip (e.g. collection of field data, leadership) and what you learned about working in a group;
g) describe three important things you learnt during the field component of the course. Please rank these (with no. 1 being the most important to either your personal or professional development). Provide a brief justification on why you ranked them in this order.

This assignment should be short (no more than 2 pages using size12 font and standard margins).
Feedback will be given individually on each report, given on last day of course. Submit on Moodle.

10% of total mark.

Learning Objectives:
- Enhance critical thinking
- Enhance communication skills
- Develop insight into personal attributes, strengths and weaknesses

13.6 Field trip identification (Individual)

You will be assessed on your abilities to identify between 20-30 plant and animal species throughout the fieldwork component of the course.

10% of total mark.

Learning Objectives:
- Enhance critical and retentive thinking
- Develop observational skills through instruction

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.

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[8]	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[9]	**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[10] Tel: 9385 5418

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