WFA8433 Natural Resource & Conservation Decision Making

Instructor:	Dr. Michael E. Colvin
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Office hour(s):	By appointment
Lecture:	Monday, Wednesday, Friday: xx:00 to xx:50
Location:	TBD

Catalog description

Three hours lecture. Natural resource and conservation decision making including rapid prototyping of decision problems, structuring objectives, structured decision making, adaptive management, and relevant case studies of successful natural resource decision making.

Required textbooks

Conroy, M. and J.T. Peterson. 2034. Decision Making in Natural Resource Management: A Structured, Adaptive Approach. Wiley-Blackwell. ISBN: 978-0-470-67174-0

Hammond, J.S., R.L. Keeney, and H. Raiffa. 1999. Smart choices: a practical guide to making better life decisions. Broadway Books. New York. ISBN: 978-0767908863

Powell, L. and G. Gale. Parameter estimation for animal populations. Caught Napping Publications. Lincoln. ISBN: 978-1329061514

Supplemental PDFs provided on course website

Course background and rationale

Natural resource managers increasingly work with diverse stakeholder groups and incorporate their values and objectives when developing management and conservation plans. Such decisions are fraught with the complexity and uncertainty associated with ecological system dynamics and multiple and potentially conflicting objectives under consideration. Structured decision making (SDM) is an approach that can incorporate multiple competing objectives and ecological uncertainties in a framework that is transparent and adaptable. It also is an ideal framework for interdisciplinary management teams to cooperate and create the most effective management strategies. The Department of the Interior (DOI) has recognized the importance of SDM and has directed DOI bureaus and offices to incorporate SDM and adaptive management strategies into their land and resource management decision making. However, there are few courses on SDM and adaptive management available to students in natural resources and related fields. This course is intended to provide graduate students from diverse backgrounds (natural resources, ecological economics, civil engineering, political science, and others) with an understanding of the SDM process used for making natural resource management and conservation decisions regardless of the level of complexity or uncertainty. Primary focus is exposing students to the logic and conceptual basis of each step of the SDM process to understand when an SDM process is appropriate and how the process produces and optimal decision when properly implemented to a natural resource management or conservation problem.

Course objectives

The class materials are intended to develop the skills needed to create basic decision models for predicting the outcomes of management actions. The culmination of this course is the course

project where students are required to integrate the skills. By the end of this course, all students should be able to:

1. Recognize and incorporate different stakeholder viewpoints into decision making
2. Work effectively with stakeholder groups using an SDM approach and recognize and ameliorate impediments to the process
3. Identify and classify stakeholder objectives and create diagrams representing their relationships
4. Quantify stakeholder objectives and identify measureable outcomes from natural resource decisions
5. Use the structured decision making process to work through a management problem with rapid-prototyping methods
6. Create and interpret graphical models of natural resource decisions
7. Use ecological methods to estimate current state conditions and integrate decision-making with monitoring
8. Use models to predict likely outcomes and associated uncertainties
9. Identify the different types of uncertainty and understand how each can be represented in a model
10. Use adaptive management to reduce system uncertainty and improve future decisions
11. Understand and describe the principles of structured decision making and adaptive management

Assessment of student progress

Student performance will be based on weekly assignments (50%; 50 total points; 10 assignments each worth 5 points), a small group project that involves the development and evaluation of a model to inform a natural resource management or conservation decision (40%; 40 total points), and presentation of the small group project to the class (10%; 10 total points). Total assessment points equal 100.

1. *Homework problem sets (50 points).*—During the course you will be given homework exercises to reinforce course topics and assess student progress. There will be 10 homework exercises worth 5 points each. All homework due 1 week from date assigned unless otherwise specified.
2. *Final project report (40 points).*—The course project is intended to evaluate the student's ability to synthesize the individual course elements and create a decision model to predict the outcomes of alternative natural resource management actions. To complete the course project, each student group will choose a unique natural resource management issue and will create a model that will be used to identify the optimal management action. The model can correspond to the topic chosen for the group project in the lecture portion of the course or can be a unique management or conservation issue of interest. The instructor must approve of the topic before the project is initiated. Each student will write a final report describing the model in detail including: the data sources, justification for including individual model components and their relations, results of sensitivity analysis, and the optimal management decision. Project will be graded based on the appropriateness of the decision, how well students described and justified the model structure, and the results and interpretation of sensitivity analysis. An example of a final report will be available on Blackboard Learn

along with a detailed report scoring rubric outlining expectations.

3. *Presentation (10 points).*—During the final exam period you will be required to present the details of your project as a 30 minute oral presentation.

Summary of evaluations:

Task	*Points*
Homework problem sets	50 (10 exercises x 5 points per exercise)
Project report	40
Report presentation	10
Total	**100**

Grading Scale

A= 90 to 100 B = 80 to 89.9 C = 70 to 79.9 D = 69.9 to 69.9
F = 0 to 59.9

Late assignment policy

Late assignments and missed exams: All assignments must be turned in on time. Late assignments may be graded, but the maximum point value will be reduced by 10% for every day the assignment is late; however, assignments will not be graded if they are turned in after assignments grades are posted on blackboard Learn. If for some reason there is a timing conflict associated with a course due date, discuss these conflicts with me at least two weeks prior to the scheduled date.

Important Dates

- Last day to drop a class without a grade: 13 January 2017
- Last day to add a class: 17 January 2017
- First progress reporting: 20 February 2017
- Last day to course with a "W" grade: 28 February 2017
- Second progress reporting: 24 March 2017
- Last day to withdraw from the university: 11 April 2017
- Classes end: 26 April 2017
- Reading day: 27 April 2017
- Final Exam: TBD 28 April – 4 May 2017

Academic misconduct

Academic integrity is serious and all disciplinary action will be taken in the event of academic dishonesty. Mississippi State has an approved Honor Code that applies to all students. The code is as follows: "As a Mississippi State University student, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do." Upon accepting admission to Mississippi State University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor Code. Student will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the MSU community from the requirements or the processes of the Honor Code. For additional information, please visit: http://honorcode.msstate.edu/policy.

Cell Phone Policy

In accordance with Academic Operating Policy 10.08 (approved July 12, 2005) and in order to limit classroom disruptions, as well as to protect against academic misconduct, the use by students of cell phones, messaging devices and other electronic devices is prohibited. In this class, students are required to put cell phone in the silent mode and stow in backpack while attending class and laboratory sessions.

Professional Expectations for Students in the Wildlife, Fisheries and Aquaculture Program

http://www.cfr.msstate.edu/wildlife/documents/professional_expectations.pdf

Academic Accommodations for Students with Disabilities

Accommodations are collaborative efforts between students, faculty and Disability Support Services (DSS). **Students with accommodations approved through DSS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations.** Students who believe they are eligible for accommodations but who have not yet obtained approval through DSS should contact DSS immediately at (662) 325-3335 (http://www.policies.msstate.edu/).

Title IX

MSU is committed to complying with Title IX, a federal law that prohibits discrimination, including violence and harassment, based on sex. This means that MSU' s educational programs and activities must be free from sex discrimination, sexual harassment, and other forms of sexual misconduct. If you or someone you know has experienced sex discrimination, sexual violence and/or harassment by any member of the University community, you are encouraged to report the conduct to MSU's Director of Title IX/EEO Programs at 325-8124 or by e-mail to titleix@msstate.edu. Additional resources are available at:

- http://www.msstate.edu/web/security/title9-12.pdf, or
- http://students.msstate.edu/sexualmisconduct/.

Class Attendance Policy

Attendance is not a formal part of grade but missed classes will likely influence learning outcomes. Class attendance policy for WFA8433 follows AOP 12.09(http://www.policies.msstate. edu/policypdfs/1209.pdf) for definitions of excused absences and as absences pertain to grading and assessments.

Class Schedule Course is comprised of 45 contact hours, divided over the semester. All homework due 1 week from date assigned unless otherwise specified.

Week	Date	Lecture topics	Readings	Homework exercises	Project timeline
1	1/9/2017	Introduction to decision making	Hammond et al.: Chapters(s) 1-3		
	1/11/2017	PrOACT process	Hammond et al.: Chapters(s) 4-6		
	1/13/2017	Making decisions: uncertainty, risk, and linked decisions	Hammond et al.: Chapters(s) 7-9		Randomly assign students to groups
2	1/16/2017	Decision trees and decision making under uncertainty			
	1/18/2017	Being a decision maker	Hammond et al.: Chapters(s) 10-11		
	1/20/2017	Decision trees and decision models		Homework 1: Creating a decision trees and the benefits of a decision model	
3	1/23/2017	Introduction to structured decision making in natural resources management	Conroy and Peterson-Chapters 1 & 2		List of preliminary problems to instructor for review
	1/25/2017	History, rational, and applications of decision making in natural resources and conservation		Homework 2: Introduction to basic computing- R	
	1/27/2017	Types of decision making philosophies in natural resources	McFadden, J. E., T. L. Hiller, and A. J. Tyre. 2011. Evaluating the efficacy of adaptive management approaches: Is there a formula for success? Journal of Environmental Management 92:1354-1359.		

Week	Date	Lecture topics	Readings	Homework exercises	Project timeline
4	1/30/2017	Structuring and quantifying objectives	Conroy and Peterson-Chapter 3 pages 24-37	Homework 3: Structuring your career objectives	
	2/1/2017	Decision Making and Working with Stakeholders	Conroy and Peterson-Chapter 4		Problem statement due
	2/3/2017	Statistics and decision making: Estimating current system states-I	Conroy and Peterson-Chapter 5		
5	2/6/2017	Statistics and decision making: Estimating current system states-II	Conroy and Peterson-Chapter 5		
	2/8/2017	Using data to estimate parameters and quantify uncertainty	Conroy and Peterson-Chapter 5: Pages 100-129 and Boxes 5.1-5.2 Page 42-55	Homework 4: Probability basics and estimation in decision analysis contexts	
	2/10/2017	Predicting outcomes in a decision context: linear models	Conroy and Peterson-Chapter 5: Pages 100-129 and Boxes 5.1-5.2 Page 42-55		
6	2/13/2017	Predicting outcomes in a decision context: generalized linear models	Conroy and Peterson-Chapter 5: Pages 100-129 and Boxes 5.1-5.2 Page 42-55		
	2/15/2017	Predicting outcomes in a decision context: hierarchical linear models	Conroy and Peterson-Chapter 5	Homework 5: Using linear models to parameterize decision models	
	2/17/2017	Estimating current states (marked populations): abundance	Larkin and Gale-Chapter 8		
7	2/20/2017	Estimating current states	Larkin and Gale-Chapter 10		

Week	Date	Lecture topics	Readings	Homework exercises	Project timeline
		(marked populations): survival			
	2/22/2017	Estimating current states (marked populations): survival & abundance	Larkin and Gale-Chapter 13		
	2/24/2017	Estimating current states (marked populations): cmr multi state	Larkin and Gale-Chapter 12		
8	2/27/2017	Estimating current states (unmarked populations): Occupancy	Larkin and Gale-Chapter 15		
	3/1/2017	Estimating current states (unmarked populations): multi season and state occupancy models	Larkin and Gale-Chapter 15	Homework 6: Estimating current system states exercises	
	3/3/2017	Estimating current states (unmarked populations): Closed and open *N*-mixture models	Larkin and Gale-Chapter 16		
9	3/6/2017	Introduction to influence diagrams	Conroy and Peterson-Chapter 6	Homework 7: Developing an influence diagram a problem of your choosing	
	3/8/2017	Using graphical models to predict outcomes	Conroy and Peterson-Chapter 6: Pages 147-179 and Boxes 6.1-6.3		
	3/10/2017	Eliciting and quantifying expert judgment	Conroy and Peterson-Chapter 6: Pages 165-191 and Box 6.1 and 6.2	Homework 8: Functional elicitation exercise	Structured influence diagram for group problem

Week	Date	Lecture topics	Readings	Homework exercises	Project timeline
10	3/13/2017	*Spring break no class*			
	3/15/2017	*Spring break no class*			
	3/17/2017	*Spring break no class*			
11	3/20/2017	Influence diagrams and decision alternatives			
	3/22/2017	Choosing the best decision alternative and evaluating the effect of uncertainty-I	Conroy and Peterson-Chapter 7 Pages 203-220		
	3/24/2017	Choosing the best decision alternative and evaluating the effect of uncertainty-II Monte Carlo Simulation	1) Conroy and Peterson-Chapter 5 (Resampling and Simulation Methods for estimating variance, bias, and confidence intervals Pages 27-30 and Boxes 5.13 Pages 94-97) 2) Conroy and Peterson-Chapter 8		
12	3/27/2017	Sensitivity analysis and estimating the value of information	1) Conroy and Peterson-Chapter 7 (Sensitivity analysis and The Value of Information, Pages 12-20) 2) Canessa, S., G. Guillera-Arroita, J. J. Lahoz-Monfort, D. M. Southwell, D. P. Armstrong, I. Chadès, R. C. Lacy, and S. J. Converse. 2015. When do we need more data? A primer on calculating the value of information for applied ecologists. Methods in Ecology and Evolution:1219-1228.	Homework 9: Sensitivity analysis and estimating the value of information using the influence diagrams assigned on 3/6	

Week	Date	Lecture topics	Readings	Homework exercises	Project timeline
	3/29/2017	Introduction to optimization	1) Conroy and Peterson-Chapter 8 (Entire contents) 2) Marescot, L., G. Chapron, I. Chadès, P. L. Fackler, C. Duchamp, E. Marboutin, and O. Gimenez. 2013. Complex decisions made simple: A primer on stochastic dynamic programming. Methods in Ecology and Evolution 4:872-884.	Homework 10: Determining optimal number of animals to translocate to where as part of a conservation stocking program.	Parameterized decision network for group problem
	3/31/2017	Case study I-Setting harvest regulations	1) Novinger, G. D. 1984. Observations on the Use of Size Limits for Black Basses in Large Impoundments. Fisheries 9:2-6 2) Peterson, J. T., and J. W. Evans. 2003. Quantitative decision analysis for sport fisheries management. Fisheries 28:10-21.		
13	4/3/2017	Case study II-Invasive species control	1) Bogich, T., and K. Shea. 2008. A state-dependent model for the optimal management of an invasive metapopulation. Ecological Applications 18:748-761. 2) Hauser, C. E., M. C. Runge, E. G. Cooch, F. A. Johnson, and W. F. Harvey. 2007. Optimal control of Atlantic population Canada geese. Ecological Modelling 201:27-36.		

Week	Date	Lecture topics	Readings	Homework exercises	Project timeline
	4/5/2017	Conflict Resolution and Knowledge Acquisition through adaptive management (AM)	Runge, M. C. 2011. An introduction to adaptive management for threatened and endangered species. Journal of Fish and Wildlife Management 2:220-233		
	4/7/2017	AM: More than just trial and error	Rist, L., B. Campbell, and P. Frost. 2013. Adaptive management: where are we now? Environmental Conservation 40:5-18		
14	4/10/2017	Learning from monitoring in AM	Conroy, M. J., and J. T. Peterson. 2009. Integrating management, research, and monitoring: balancing the 3-legged stool. Pages 2-10 in S. B. Cederbaum, B. C. Faircloth, T. M. Terhune, J. Thompson, and J. P. Carroll, editors. Gamebird 2006: Quail VI and Perdix XII. 31 May - 4 June 2006. Warnell School of Forestry and Natural Resources, Athens, Georgia.		80% Final report draft due
	4/12/2017	Prioritizing learning: Passive versus active AM	Walters, C. J., and C. S. Holling. 1990. Large-scale management experiments and learning by doing. Ecology 71:2060-2068		
	4/14/2017	*University holiday-no class*			
15	4/17/2017	Case study-black duck management	Conroy and Peterson-Chapter 9		

Week	Date	Lecture topics	Readings	Homework exercises	Project timeline
	4/19/2017	Case study-Golden Eagles and trail closures in Denali National Park	Fackler, P. L., K. Pacifici, J. Martin, and C. McIntyre. 2014. Efficient Use of Information in Adaptive Management with an Application to Managing Recreation near Golden Eagle Nesting Sites. Plos One 9:1-14.		
	4/21/2017	Case study-reconnection of fragmented habitats	Tyre, A. J., J. T. Peterson, S. J. Converse, T. Bogich, D. Miller, M. Post van der Burg, C. Thomas, R. Thompson, J. Wood, D. C. Brewer, and M. C. Runge. 2011. Adaptive Management of Bull Trout Populations in the Lemhi Basin. Journal of Fish and Wildlife Management 2:262-281.		
16	4/24/2017	Case study-Adaptive management of horseshoe crabs and red knots	Smith, D. R., C. P. McGowan, J. P. Daily, J. D. Nichols, J. A. Sweka, and J. E. Lyons. 2013. Evaluating a multispecies adaptive management framework: must uncertainty impede effective decision-making? Journal of Applied Ecology 50:1431-1440.		
	4/26/2017	Advanced topics in SDM and AM: Risk and extreme uncertainty			
	April 28 - May 4	Final Exam Period: In class presentations of final project			Project-Final reports due