

ECO 601 -- RESEARCH CONCEPTS IN ENVIRONMENTAL CONSERVATION

(#74146, 3 credits)

<http://people.umass.edu/sdestef>

Fall Semester 2010 Course Description

INSTRUCTOR: Dr. Stephen DeStefano, 314 Holdsworth Natural Resources Center
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office hours: Mon., Wed. 10:00-11:00

TEACHING ASSISTANT: Dave Wattles, dwattles@eco.umass.edu

CLASS MEETINGS: Monday, Wednesday, Friday 8:45-9:55, HOLDSWORTH 308

TEXT AND READINGS: Papers in major scientific journals and other readings.

Optional references:

Booth, W. C., G. G. Colomb, and J. M. Williams. 2003. *The craft of research*. U. of Chicago Press, Chicago, IL.
Braun, C. E., editor. 2005. *Techniques for wildlife investigations and management*. 6th ed. TWS, Bethesda, MD.
Day, Robert A., and B. Gastel. 2006. *How to write and publish a scientific paper*. Cambridge Univ. Press, UK.
Ford, E. David. 2000. *Scientific method for ecological research*. Cambridge University Press, Cambridge, UK.
Morrison et al. 2001. *Wildlife study design*. Springer-Verlag, NY.
Strunk, W., Jr. 2009. *The elements of style*. SMK Books.

COURSE DESCRIPTION AND OBJECTIVES:

Introduction to the research process in the natural resources and environmental conservation sciences. Course will focus on research philosophy, concepts, and design, but will progress through the entire research cycle, from development of hypotheses, questions, and proposals, to grants and budgeting, to delivery of research products.

This course also serves as an orientation to your department and your graduate program, and an introduction to your fellow graduate students in the Department of Environmental Conservation.

Goals are:

1. To provide a foundation of basic concepts and approaches for designing research that can be applied universally in environmental conservation, including ecology, fisheries and wildlife biology, forestry, human dimensions, watershed management, and the built environment.
2. To investigate the entire research cycle, from development of hypotheses and proposals, to designing and implementing research, to reporting results.
3. To discuss current and ongoing issues integral to conducting research, such as hypothesis testing, funding, logistics, and advocacy.
4. To become familiar with some major scientific literature on research approaches, concepts, and design.
5. To prepare a working written draft of your graduate research proposal and to present your proposed research to the department for discussion and critique.

COURSE GRADING:

Midterm exam (25%), draft proposal (25%), proposal presentation (25%), participation and miscellaneous assignments (25%).

ACADEMIC HONESTY:

The University requires honesty of all its members in their academic work. Honesty is necessary to the learning process, and is integral to the atmosphere of genuine inquiry and intellectual curiosity that the University seeks to foster. Academic dishonesty not only contradicts the expectations of a community whose central purpose is the pursuit of intellectual endeavor, it violates University rules and regulations, a fact of which all students must be aware. See the web site http://www.umass.edu/dean_students/codeofconduct/acadhonesty/ for further information.

SPECIAL NEEDS:

Please contact me if you have special needs or requirements in order for you to take and participate in this course. The web site <http://www.umass.edu/disability/> has additional information.

GRADUATE STUDENT GUIDELINES:

UMass Graduate School (handbook): <http://www.umass.edu/gradschool/handbook/>

Graduate program in ECO (handbook): <http://jamba.provost.ads.umass.edu/web/handbook.doc>

Wildlife, fish and con. biology concentration: <http://jamba.provost.ads.umass.edu/web/wildlife.doc>

Forest resources and arboriculture: <http://jamba.provost.ads.umass.edu/web/forest.doc>

Water, wetlands and watersheds: <http://jamba.provost.ads.umass.edu/web/water.doc>

Building systems: <http://jamba.provost.ads.umass.edu/web/building.doc>

Environmental policy and human dimensions: <http://jamba.provost.ads.umass.edu/web/human.doc>

READING LIST:

Alverson, D. L. 2002. Factors influencing the scope and quality of science and management decisions (The good, the bad and the ugly). *Fish and Fisheries* 3:3-19.

Anderson, D. R. 2001. The need to get the basics right in wildlife field studies. *Wildlife Society Bulletin* 29:1294-1297.

Anderson, D. R., et al. 2003. Rigorous science: suggestions on how to raise the bar. *Wildlife Society Bulletin* 31:296-305.

Anderson, M. S., and J. P. Swazey. 1998. Reflections on the graduate student experience: an overview. *New Directions for Higher Education* 101:3-13.

Belovsky, G. E., et al. 2004. Ten suggestions to strengthen the science of ecology. *BioScience* 54:345-351.

Benda, L. E., et al. 2002. How to avoid train wrecks when using science in environmental problem solving. *BioScience* 52:1127-1136.

- Bloom, F. E. 1999. The importance of reviewers. *Science* 283:789.
- Burnham, K. P., and D. R. Anderson. 2001. Kullback-Leibler information as a basis for strong inference in ecological studies. *Wildlife Research* 28:111-119.
- Burnham, K. P., and D. R. Anderson. 1998. Model selection and inference, a practical information-theoretic approach. Springer, New York.
- Canadian Council on Animal Care. 2003. Guidelines on: the care and use of wildlife. Canadian Council on Animal Care, Ottawa, Ontario.
- Chamberlin, T. C. 1965. The method of multiple working hypotheses. *Science* 148:754-759.
- Connell, J. H. 1961a. Effects of competition, predation by *Thais lapillus*, and other factors on natural populations of the barnacle *Balanus balanoides*. *Ecological Monograph* 31:61-104.
- Connell, J. H. 1961b. The influence of interspecific competition and other factors on the distribution of the barnacle *Chthamalus stellatus*. *Ecology* 42:710-723.
- DeStefano, S., and R. J. Steidl. 2001. The professional biologist and advocacy: what role do we play? *Human Dimensions of Wildlife* 6:11-19.
- Dickson, J. G., and R. N. Conner. 1978. Guidelines for authorship of scientific articles. *Wildlife Society Bulletin* 6:260-261.
- Eberhardt, L. L., and J. M. Thomas. 1991. Designing environmental field studies. *Ecological Monographs* 61:53-73.
- Fischer, R. A., and S. L. King. 1998. Suggestions for new and aspiring graduate students in wildlife science. *Wildlife Society Bulletin* 26:41-50.
- Gavin, T. A. 1989. What's wrong with the questions we ask in wildlife research? *Wildlife Society Bulletin* 17:345-350.
- Gavin, T. A. 1991. Why ask "why": the importance of evolutionary biology in wildlife science. *Journal of Wildlife Management* 55:760-766.
- Garton, E. O., J. T. Ratti, and J. H. Giudice. 2005. Research and experimental design. Pages 43-71 in C. E. Braun, ed. *Techniques for wildlife investigations and management*. 6th edition. The Wildlife Society, Bethesda, Maryland, USA.
- Guthery, F. S., L. A. Brennan, M. J. Peterson, and J. J. Lusk. 2005. Information theory in wildlife science: critique and viewpoint. *Journal of Wildlife Management* 69:457-465.
- Hulbert, S. H. 1984. Pseudoreplication and the design of ecological field experiments. *Ecological Monographs* 54:187-211.

- Hunter, M. L., Jr. 1989. Aardvarks and Arcadia: two principles of wildlife research. *Wildlife Society Bulletin* 17:350-351.
- Johnson, D. H. 1999. The insignificance of statistical significance testing. *Journal of Wildlife Management* 63:763-772.
- Kroodsma, D. E., and B. E. Byers. 2000. Suggestions for slides at scientific meetings. *Auk* 117:831-835.
- Lackey, R. T. 2006. Axioms of ecological policy. *Fisheries* 31:286-290.
- Lackey, R. T. 2004. Normative science. *Fisheries* 29:38-39.
- Marsh, H., and R. Kenchington. 2004. The role of ethics in experimental marine biology and ecology. *Journal of Experimental Marine Biology and Ecology* 300:5-14.
- Matter, W. J., and R. W. Mannan. 1989. More on gaining reliable knowledge: a comment. *Journal of Wildlife Management* 53:1172-1176.
- Marra, G. G. 1974. The dilemma in academic research. *Forest Products Journal* 24:58-61.
- Mazerolle, M. J. 2004. Making sense out of Akaike's Information Criterion (AIC): its use and interpretation in model selection and inference from ecological data. Appendix 1 *in* *Mouvements et reproduction des amphibiens en tourbières perturbées*. Ph.D. dissertation, Université Laval, Québec, Canada.
- Mayr, E. 1997. *This is biology, the science of the living world*. Belknap Press, Harvard University Press, Cambridge, Massachusetts.
- McPherson, G. R. 2001. Teaching and learning the scientific method. *American Biology Teacher* 63:242-245.
- McPherson, G. R., and S. DeStefano. 2003. *Applied ecology and natural resource management*. Cambridge University Press.
- Mulcahy, D. M. 2003. Does the Animal Welfare Act apply to free-ranging animals? *ILAR Journal* 44:252-258.
- Myers, R. A., and B. Worm. 2003. Rapid worldwide depletion of predatory fish communities. *Nature* 423:280-283.
- Murphy, D. D., and B. R. Noon. 1991. Coping with uncertainty in wildlife biology. *Journal of Wildlife Management* 55:773-782.
- O'Donohue, W., and J. A. Buchanan. 2001. The weaknesses of strong inference. *Behavior and Philosophy* 29:1-20.
- Oksanen, L. 2001. Logic of experiments in ecology: is pseudoreplication a pseudoissue? *Oikos* 94:27-

38.

- Paine, R. T. 1963. Trophic relationships of eight sympatric predatory gastropods. *Ecology* 44:63-73.
- Paine, R. T. 1966. Food web complexity and species diversity. *American Naturalist* 100:65-75.
- Paine, R. T. 1971. A short-term experimental investigation of resource partitioning in a New Zealand rocky intertidal habitat. *Ecology* 52:1096-1106.
- Platt, J. R. 1964. Strong inference. *Science* 146:347-353.
- Powell, R. A., and G. Proulx. 2003. Trapping and marking terrestrial mammals for research: integrating ethics, performance criteria, techniques, and common sense. *ILAR Journal* 44:259-276.
- Questad, E., and A. K. Knapp. 2007. A match made in academia: you and your graduate advisor. *Frontiers in Ecology and the Environment* 5:390-391.
- Rissman, E. F. 2004. Thinking outside the mouse box: the importance of comparative laboratory animal models in research. *ILAR Journal* 45:1-3.
- Romesburg, H. C. 1981. Wildlife science: gaining reliable knowledge. *Journal of Wildlife Management* 45:293-313.
- Romesburg, H. C. 1989. More on gaining reliable knowledge: a reply. *Journal of Wildlife Management* 53:1177-1180. (See Matter and Mannan 1989)
- Romesburg, H. C. 1991. On improving the natural resources and environmental sciences. *Journal of Wildlife Management* 55:744-756.
- Romesburg, H. C. 1993. On improving the natural resources and environmental sciences: a reply. *Journal of Wildlife Management* 57:184-189. (See Knight 1993)
- Russow, L.-M., and P. Theran. 2003. Ethical issues concerning animal research outside the laboratory. *ILAR Journal* 44:187-190.
- Steidl, R. J., J. P. Hayes, and E. Schaubert. 1997. Statistical power analysis in wildlife research. *Journal of Wildlife Management* 61:270-279.
- Sterns, S., and R. Huey. 1987. Some modest advice to graduate students. *Bulletin of the Ecological Society of America* 68:145-153.
- Wyatt, S., and N. Thiffault. 2005. How to wreck your own presentation: twelve tips to confuse an audience. *Forestry Chronicle* 81:498-500.

ECO 601 – RESEARCH CONCEPTS IN ENVIRONMENTAL CONSERVATION
Fall Semester 2010 Syllabus

Date	Topic	Assignments/Readings/References/Notes
1. Sep. 8 (W)	Introductions and Orientation Course structure, objectives, and schedule	DEC Web Site, UMass Graduate School Handbook, and Department of Environmental Conservation guides and handbooks >>> see appropriate web links
2. Sep. 13 (M)	History of Science and Scientific Thought	<i>(Note: class begins at 8:45 for remainder of semester, Mondays and Wednesdays)</i> <i>(Note: Mass. Transportation & Wildlife Conference Sept. 12-15)</i>
3. Sep. 15 (W)	Philosophers of Science	Read Mayr 1997 Chapters 1 & 2
4. Sep. 20 (M)	Hypotheses	Read McPherson 2001, Chamberlin 1890, Platt 1964, (O'Donohue and Buchanan 2001) <i>(Note: 21 Sept. is last day to ADD/DROP)</i>
5. Sep. 22 (W)	Science and the Scientific Method The Null Hypothesis	Ref. Johnson 1999
6. Sep. 27 (M)	Proposal Writing I - Overview: why write a proposal?; basic structure; logistics; examples	Proposal example
7. Sep. 29 (W)	Proposal Writing II - The Literature Proposal Writing III - Titles, abstracts, introductions, objectives	I. BRIEF STATEMENT OF PROPOSED RESEARCH or PROFESSIONAL PAPER
8. Oct. 4 (M)	Proposal Writing IV - Conceptual models; methods	
9. Oct. 6 (W)	Proposal Writing V – Objectives through Discussion	II. PROPOSAL: TITLE & INTRODUCTION (including objectives & questions), and, LITERATURE: ≥5 IMPORTANT CITATIONS
Oct. 11 (M)	NO CLASS	<i>(Note: Columbus Day Holiday)</i>
10. Oct. 12 (Tue.)	Questions and Hypotheses: NOGO example Proposal Writing VI – Anticipated results; research & management implication; schedule	<i>(Note: Follow Monday's schedule)</i>
11. Oct. 13 (W)	Design Concepts 1	III. PROPOSAL: CONCEPTUAL MODEL

12. Oct. 18 (M)	Design Concepts 2	<i>(Note: last day to drop with "DR")</i>
13. Oct. 20 (W)	Design Concepts 3	IV. PROPOSAL: STUDY AREA & METHODS <i>(Note: Thursday, 21 Oct., is Mid-semester)</i>
14. Oct. 25 (M)	Designed Experiments	Optional reading: Connell 1961a, 1961b; Paine 1963, 1966, 1971
15. Oct. 27 (W)	Basic Budget Considerations	V. PROPOSAL: ANTICIPATED RESULTS & SCHEDULE
16. Nov. 1 (M)	Applying for Grants	
17. Nov. 3 (W)	Miscellaneous ideas re. research (H-D method, why ask why? Arcadia & aardvarks?) Proposal progress	Read Romesburg 1981, Gavin 1991, Hunter 1989
18. Nov. 8 (M)	Oral Presentations, including using PowerPoint	Ref. Kroodsma and Byers 2000, Wyatt and Thiffault 2005
Nov. 10 (W)	NO CLASS	<i>(Note: Follow Thursday's schedule)</i>
19. Nov. 15 (M)	EXAM	MATERIAL UP TO AND INCLUDING 8 NOV.
20. Nov. 17 (W)	Final preparations for written proposals	WRITTEN PROPOSALS TO GROUP
21. Nov. 22 (M)	Student proposals: exchange and discussion	Ref. Dickson and Conner 1978, Bloom 1999
22. Nov. 24 (W)	Student proposals: exchange and discussion	<i>(Note: 25-28 Nov. is Thanksgiving recess)</i>
23. Nov. 29 (M)	Student presentations: practice and critique	
24. Dec. 1 (W)	Student presentations: practice and critique	
25. Dec. 3 (F)	Student presentations: practice and critique	
26. Dec. 6 (M)	Student presentations: practice and critique	TITLES AND BRIEF BIOGRAPHIES TO T.A.
27. Dec. 8 (W)	Student presentations: practice and critique	LOAD ALL PPT TALKS
28. Dec. 10 (F)	GRAD RESEARCH PROPOSAL CONFERENCE -- 312A HOLDSWORTH	HALF-DAY to ALL DAY (depending on number of presentations) <i>(Note: Dec.10 is the last day of classes)</i>