Methods in Experimental Ecology II

PCB 6468

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Class website: http://pascencio.cos.ucf.edu/methods%20presentation%202015.html
- here you will find all the materials necessary for classes and exercises.

Fall 2016

Course description:
This course will assist graduate students to design, analyze and interpret their own experiments and observations and establish a research program in ecology and other biological fields. This course reviews basic analytical tools needed to collect, organize and interpret ecological data in a critical way. It is based on the revision of case studies illustrating frequent research problems and the discussion of potential solutions. As much as possible, several alternative approaches are evaluated and compared. This class complements courses on basic statistics and is directed to beginning graduate and senior undergraduate researchers. The course confronts concepts in experimental design, execution and analysis as a tool to improve ecological research.

Prerequisites:
PCB 6466 Methods in Ecology I or Instructor Consent (CI)

This class will provide basic information and practical advice on how to ask pertinent questions, and improve experimental execution, design, analysis and interpretation in ecology.

Estimated enrollment: **10-20**

Methods in experimental ecology II

Course Outline

This course constitutes a review to experimental methods in ecology. Individual sections cover aspects of data collection, analysis and interpretation of ecological experiments, and measurements of organisms and their environment.

Main goals for students in this course:

- **Design sampling programs that represent the best use of available resources**
- **Avoid mistakes that make our data difficult to analyze**
- **Review and discuss case studies to recognize common research problems in ecology**
- **Apply available statistical analysis in a critical way to address ecological research problems**
- **Compare different ecological and statistical techniques**
- **Recognize the advantages and limitations of different approaches to evaluate ecological data**

Course Prerequisites: The student should have taken PCB 6466 Methods in Ecology I or Instructor Consent (CI)

Student duties:

Conduct: Students must follow the University standards for personal and academic conduct as outlined in the Golden Rule (http://www.goldenrule.sdes.ucf.edu/).

Demos: Students will complete daily in-class exercises using R and other programs, and discuss, analyze and interpret ecological data.

Exercises: For each topic, students will have ***one week*** to complete an exercise.

Readings: We suggest the use of

Kéry, M. 2010. **Introduction to WinBugs for Ecologists**. Elsevier.

Zuur, A.F., J.M. Hilbe and E.N. Ieno. 2015. **A beginner's guide to GLM and GLMM with R**. Highlands Statistics Ltd.

Specialized literature will be used to review examples of experimental ecology research and specific topics.

Class schedule:

Session	Room	TOPIC	Date
0	Bio-305	Class Presentation	Jan 13
1	Bio-305	Why worry about assumptions? / Exercise 1	**Jan 15 - Assumptions**
2	Bio-305	Two Frameworks: Frequentist and Bayesian	Jan 20
3	Bio-305	Why Bayesian? The model of the mean / Exercise 2	**Jan 22 - Averages**
4	Bio 305	Logistic regression	Jan 27
5	Bio 305	Logistic regression / Exercise 3	**Jan 29 - Logistic regression**
6	Bio-305	Are all models linear?	Feb 3
7	Bio-305	Nonlinear / Exercise 4	**Feb 5 - Non linear**
8	Bio-305	How to deal with count data?	Feb 10
9	Bio-305	Count data / Exercise 5	**Feb 12 - Count data**
10	Bio-305	Non-independence	Feb 17
11	Bio-305	Mixed Models / Exercise 6	**Feb 19 - Mixed Models**
12	Bio-305	GLMM - Mixed Models	Feb 24
13	Bio-305	Mixed Models / Exercise 7	**Feb 26 - Mixed Models II**
14		**Review and questions**	Mar 2
15		**EXAM #1**	**Mar 4**
16		*Spring Brake*	*Mar 7-12*
17	Bio-305	How to deal with zeroes?	Mar 16
18	Bio-305	Zero Inflated Models / Exercise 8	**Mar 18 - Zero Inflated**
19	Bio-305	Non-linear counts?	Mar 23
20	Bio-305	Nonlinear counts / Exercise	**Mar 25 - Non-linear counts**
21	Bio-305	Categorical Data	Mar 30
22	Bio-305	Analysis of categorical Data / Exercise 10	**Apr 1 - Categorical Data**
23	Bio-305	**Your data & Readings**	Apr 6
24	Bio-305	**Your data & Readings**	**Apr 8**
25	Bio-305	**Your data & Readings**	Apr 13
26	Bio-305	**Your data & Readings**	**Apr15**
27	Bio-305	**Review and questions**	Apr 20
28	Bio-305	**EXAM #2**	**Apr 22**
		FINAL EXAM (as scheduled)	

EXAMPLES OF SUPPORT AND ADDITIONAL REFERENCES

Burgman, M. 2011. Remedies for a scientific disease. Bulletin of the British Ecological Society 42:1

Burnham K. P. and D. Anderson. 2002. Model selection and multimodal inference. Springer.

Colegrave, N and G. D. Ruxton. Confidence intervals are a more useful complement to nonsignificant tests than are power calculations Behavioral Ecology 14: 446-450.

Crawley, M. J. 2005. Statistics: an introduction using R. Wiley.

Crowley, P. H. 1992. Resampling methods for computation-intensive data analysis in ecology and evolution. Annual Review of Ecology and Systematics 23: 405-447.

Eberhardt, L.L. and J.M. Thomas. 1991. Designing environmental field studies. Ecological Monographs 61: 53-73.

Ellison, A.M. 1996. An introduction to Bayesian inference for ecological research and environmental decision-making. Ecological Applications 6: 1036-1046.

Fidler, F., M. A. Burgman, G. Cumming, R. Buttrose, and N. Thomason. 2006. Impact of criticism of null-hypothesis significance testing on statistical reporting practices in Conservation Biology. Conservation Biology 20: 1539-1544.
Dutilleul, P. 1993. Spatial heterogeneity and the design of ecological field experiments. Ecology 7: 1617-1628.
Quinn, M. and J. Keough. 2002. Experimental Design and Data Analysis for Biologists Cambridge.
Gibson, D.J. 2002. Methods in comparative plant population ecology. Oxford.
Gotelli and Ellison. 2004. A Primer of Ecological Statistics. Sinauer.
Gurevitch, J. and T. Chester. 1986. Analysis of repeated measures experiments. Ecology 67: 251-255.
Hilborn, R. and M. Mangel. 1997. The Ecological Detective: confronting models with data. Princeton.
Hurlbert, S.H. 1984. Pseudoreplication and the design of ecological field experiments. Ecological Monographs 54: 187-211.
Hoenig, J. M. and D. M. Heisey. 2001. The abuse of power: the pervasive fallacy of power calculations for data analysis. The American Statistician 55: 19-24.
Magnusson and Mourão . 2004. Statistics without Math. Sinauer.
McCarthy, M.A. 2007. Bayesian methods for Ecology. Cambridge.
Manly B.F.J. 1997. Randomization, Bootstrap and Monte Carlo Methods in Biology, Chapter 1. Chapman & Hall
McKone, M.J. y C.M. Lively. 1993. Statistical analysis of experiments conducted at multiple sites. Oikos 67: 184-186Scheiner, S. M. and J. Gurevitch. 1993. Design and analysis of Ecological Experiments. 1993. Chapman Hall.

Potvin, C., M.J. Lechowicz y S. Tardif. 1990. The statistical analysis of ecophysiological reposponse curves obtained from experiments involving repeated measures. Ecology 71: 1389-1400.
Potvin, C. and D.A. Roff. 1993. Distribution-free and robust statistical methods: viable alternatives to parametric statistics? Ecology 74: 1617-1628.
Platt, J.R. 1964. Strong inference. Science 146: 346-353.
Shen, J. 1995. On choosing an appropriate ANOVA for ecological experiments Oikos 73: 404.
Sokal, R.R. y F.J. Rohlf. Biometry: The Principles and Practice of Statistics in Biological Research, Chapter 10. W.H. Freeman, New York.
Stephens, P. A., S. W. Buskirk, and C. Martinez del Rio. 2006. Inference in ecology and evolution. Trends in Ecology and Evolution 22: 193-196.
Underwood, A.J. 1998. Experiments in Ecology; Their Logical Design and Interpretation Using Analysis of Variance, Chapter 2. Cambridge University Press, Cambridge.

Performance Evaluation:

- *10 exercises (5 points each): 50 points*
- *Two **cumulative** exams (15 points each): 30 points*
- *Final **cumulative** exam: 20 points*
- *Total 50 + 30 + 20 = 100 points*
- *Grade scale: A = 90-100; B = 80-89; C = 70-79; D = 60-69; F= below 60*