Natural Reserve System
FIELD STUDIES PROGRAM

California Ecology & Conservation
Course Description and Grading Scheme
Fall 2016

***Instructors**:*

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***Course Goals**:*

- Understand the *process* of science
- Become fluent in the *practice* of science, from hypothesis formulation to conclusion
- Develop skills and comfort in the visual, oral, and written presentation of science
- Gain experience in the tenets of experimental design
- Gain experience in making measurements related to population ecology, community ecology, and behavioral ecology
- Become practiced in the basics of data analysis and graphing
- Develop comfort in both collaborative and independent research
- Appreciate the importance of natural history and context to ecological investigations
- Gain familiarity with the flora, fauna, and landscapes of California
- Gain appreciation for the complexity of the natural world and for the power of well-formulated hypotheses to slice through that complexity.
- Gain further understanding of how geology, geography, climatology, and history relate to the distribution and abundance of organisms in California
- Understand fundamental global conservation challenges
- Have an amazing experience in some of the world's most beautiful places!

***Evaluations & Grading**:*

Journal Article #1 Presentation	5%
Research Project #1 Presentation	5%
Journal Article #2 Presentation	5%
Research Project #2 Writing Assignment	5%
Research Project #3 Manuscript Peer Review	5%
Research Project # 3 Paper	20%
Final Research Project Presentation	20%
Final Research Project Paper	30%
Engagement and Research Effort	5%

General Course Description:

The California Ecology & Conservation course represents the academic equivalent of four on-campus lecture and laboratory courses, for a total of 19 quarter credits or 15 semester credits, depending upon your home campus. It will combine lectures, natural history explorations, field demonstrations and practicals, statistical demonstrations and practicals, group discussions and workshops, and student-led research and peer review, all focused on building fluency in the process and practice of science. Students will be in the field at University of California Natural Reserves (http://nrs.ucop.edu) for the entire duration of the course.

The early weeks are dedicated to orienting students to the present moment in science and their place in it and toward incrementally building up a tool set for student-led scientific investigation. Students will receive training in the basics of the scientific process and in the skills to carry it out in the field. This training will cover hypothesis formulation, sampling design and experimental design in hypothesis testing, methods for sampling plant and animal communities, methods for statistical analysis and visual representation of data, and tips for presenting scientific research in poster, presentation, and written forms.

The middle weeks of the course will see students put this toolset into practice as they develop their own questions for research in small groups. The class will arrive at a new reserve and set out into the field to immerse in the natural history of the landscape and begin to pose questions based on observation and discussion. Returning from the field, students will lead short presentations on previous research at the site to further orient the class on existing ecological understanding for the area. Students will then break into small research teams and set back out into the field to refine questions into testable hypotheses. Following this pilot research, each group will propose a formal research plan to the class for peer review and discussion, through which they will arrive at a final set of questions and methods for testing those questions. Research groups will then implement their plan to conduct a full investigation of the questions posed, presenting their findings to the class upon completion.

The final weeks of the course will see students marshal all of this training for a research project of their choosing at the Big Creek Reserve in Big Sur. The final research project will be undertaken in groups of four or five, and will culminate with a conference-style research presentation to the class and guests at the Blue Oak Ranch Reserve and with a full-length co-authored research paper written in the style of journal articles published in *Ecology* or *Conservation Biology.*

Students will develop competence and comfort in conducting and framing ecological and conservation research, with emphasis on key topics of:

- **Literature review**
    - Development of general conceptual framework for field study
    - Understanding of previous research into these concepts and how the specific question to be investigated fits within that intellectual context
    - Explanation of relevant specific background, including studies using similar methodologies and approaches, or conducted in similar ecological contexts

- **Natural history**
  - Identification of focal species and interactions important to the study
  - Consideration of how alternative ecological contexts might impact findings
- **Statistical considerations in study design**
  - Basic concepts in inductive reasoning and inferential statistics (sampling design, sample size, statistical power, bias)
  - Identification of factors and variables for field measurement (types of data: nominal, categorical, continuous, interval)
- **Field methods and practical considerations**
  - Specific tools to measure field variables (e.g., quadrats, transects, distance sampling, line-intercept, point sampling, vertebrate and invertebrate trapping, mark-recapture, behavioral sampling)
  - Time, money and sample size tradeoffs
  - Allocation of resources (personnel and funding)
  - Computers and other electronic tools in the field
- **Execution of field research**
  - Data collection in the field, adapting protocols and sampling design in the field
  - Data entry in the field
  - Pilot studies and rethinking field study design
- **Preliminary data analysis**
  - Preliminary data summary and visualization, power analysis
  - Data-driven adjustment of field study design
- **Data analysis and visualization**
  - Basic data summary and visualization using Excel and JMP
  - Statistical considerations – which tests to use
    - General linear models
    - Correlation and regression (linear and non-linear)
    - Multivariate statistics (e.g., multiple regression, ordination, clustering, discriminant analysis)
- **Scientific writing**
  - General framework and specific contents
  - Scientific writing: outlining, paragraph structure, grammar
  - Literature searches (e.g., Web of Knowledge, Google Scholar)
  - Bibliographies (use of online bibliographic software, e.g., Mendeley, Zotero)
  - Critical review

Required Textbook

Gotelli, N.J. and A.M. Ellison. 2013. *A Primer of Ecological Statistics,* 2nd Edition. Sinauer Associates, Inc., Sunderland, MA.