



CIEE Monteverde, Costa Rica

Course name:	Independent Study in Biology/Ecology
Course number:	BIOL 3002 MVCR / ECOL 3003 MVCR
Programs offering course:	Costa Rica: Monteverde - Tropical Ecology & Conservation
Language of instruction:	English
U.S. Semester Credits:	4 semester/6 quarter hours
Contact Hours:	60 hours
Term:	Fall 2019

Course Description

Students develop a research proposal and carry out an investigation in tropical ecology, agriculture, sustainable development, or environmental education. The project will reflect the student's interest and will be agreed upon by the student and an advisor. The project includes making initial observations and building them into testable hypotheses, selecting the appropriate experimental design and statistics, writing the research proposal, collecting appropriate data, submitting two written manuscripts formatted for publication, reviewing a peer's manuscripts, and presenting results in a scientific symposium open to the Monteverde community.

Learning Objectives

In the completion of this course, students will:

- Devise an original research project, write a proposal to carry out the project, and then implement the plan
- Gain experience and knowledge of essential field techniques in tropical ecology
- Learn basic principles of experimental design and statistics
- Gain experience in critiquing a scientific manuscript
- Have enhanced experience and skills in the communication of scientific studies
- Create new scientific knowledge that is communicated through written and oral venues

Course Prerequisites

None

Methods of Instruction

- Students will devise (with guidance) a research project proposal at the beginning of the term that will provide initiative, outline an experimental strategy, and serve as a request for funding of consumable supplies from the program (and possibly outside sources). To do so, students (under faculty guidance) conduct firsthand observations in the field, hold brainstorming sessions to devise and discuss relevant questions and hypotheses of an ecological or evolutionary nature about a topic of interest. Students meet with faculty on a one-on-one basis to select a research topic, identify the central question/s, design appropriate experiments, and select statistical analyses. Students attend a lecture to have guidance on how to propose a scientific study and select appropriate statistical



tests and experimental design. Student carry out literature research using peer-reviewed scientific publications. This process culminates in the writing of a research proposal.

- Student conduct the proposed field research During the data collection phase, students and faculty advisors meet weekly, one-on-one, to review progress and set goals for the next week. Students will take primary responsibility for conducting research and do so with professional attitudes and time commitments.
- Following data collection, analyze their data and prepare a manuscript suitable for publication in a scientific journal. Students attend a second class on statistical analyses and receive instruction on how to write a scientific manuscript. Students submit a first draft of their report, receive feedback, as well as provide feedback to another student on his/her manuscript. Based on faculty and peer reviews, each student submits a revised version.
- In the final phase, students prepare a talk in which they will present their results. Students attend a lecture on how to prepare a scientific talk for a professional society, they deliver the talk in a symposium open to the Monteverde community, and then receive feedback on their performance.
- Students well be self-motivated and work independently, approaching the advisor for guidance regularly.

Assessment and Final Grade

Project Proposal	10%
First submission of manuscript	40%
Final paper	30%
Peer review	5%
Symposium presentation	10%
Participation	5%

Course Requirements

Project Proposal

Students will use relevant scientific publications to propose and justify a scientific investigation. They will develop, in the proposal, supporting methods (including experimental design and statistical analyses) and consider the significance of various outcomes. This proposal will be formatted for a formal submission to a scientific committee. It will be 3-5 pages in length and include: Title, Introduction, Methods, Preliminary Results, Anticipated Results and Literature Cited.

First Submission of Manuscript

A fully formatted version of the project ready to be submitted to *Biotropica*, the scientific journal of the Association for Tropical Biology and Conservation. This will be 5-7 pages in length and will contain: Title, Introduction, Materials and Methods, Results (with appropriate statistics, figures and tables), Discussion and Literature Cited.



Final Paper

Students revise their first submission and re-submit with corrections that are based on the review of their advisor and a peer. Evaluation will be based on the overall quality of the manuscript at this stage.

Peer Review

Students will be evaluated on their critique of a fellow student's first submission. Accuracy, insight, breadth and depth of comments will be considered. Correcting typos will be awarded 1 point, grammar 2 points, broad suggestions 3 points, broad and specific suggestions that improve the manuscript 4 points, insightful comments that significantly improve the manuscript 5 points.

Symposium Presentation

An oral presentation of the experimental results in the form of a PowerPoint presentation will be given during a student symposium. Talks of 8-10 minutes duration will include: Title, Introduction, Materials and Methods, Results (including appropriate figures, tables and statistics) and Discussion (with general conclusions). Questions will follow and students will be evaluated on their ability to address them.

Participation

Students participate in sessions (small group, some in the field) in which observations of interest are discussed in terms of research topics. Evaluation is based on the quality of commentary and contribution to group workshops. Students will meet once weekly with their advisors to show progress during the data collection phase. Evaluation is based on the degree of commitment to the project, the ability to balance independence while seeking help when needed, care in setting up the project, quality of the data and other observations, experimental insight and care in cleaning up after the project. The expectation for data collection is no less than 4 hours per day for 20 days, or a total of 80 hours in the field, plus time collating, analyzing, constructing figures and all other components.

Weekly Schedule

Week 1 Field trip 1 (classes and activities on location).
 Topic 1: Introduction to field research methods.

Activities:

Workshop on common field techniques

Evaluations:

Participation (field techniques)

Readings:

Ambrose *et al.* 2007. *A Handbook of Biological Investigation*



Week 2 Field trip 1 continued (classes and activities on location).
Topic 2: Group field project design, implementation, and presentation, part 1.
Students work in small groups with an advisor to devise a study question, select methods, implement data collection and analysis, and then communicate the results to peers

Activities:

Group field project: planning, execution, and presentations Project meetings in small groups

Evaluations:

Participation (project meetings, group field projects, and presentations)

Readings:

Ambrose *et al.* 2007. *A Handbook of Biological Investigation* Selected literature relevant to topic of group field project.

Week 3 Topic 3: Group field project design, implementation, and presentation, part 2.
Students work in small groups with an advisor to devise a study question, select methods, implement data collection and analysis, and then communicate the results to peers

Activities:

Group field project: planning, execution, and presentations Project meetings in small groups

Evaluations:

Participation (project meetings, group field projects, and presentations)

Readings:

Ambrose *et al.* 2007. *A Handbook of Biological Investigation* Selected literature relevant to topic of group field project.



Week 4 Topic 4: Independent research. Students learn about how to select and frame research questions, and how to conduct literature reviews

Activities:

Individual brainstorming session with advisor
Independent literature review

Evaluations:

Participation (brainstorming session)

Readings:

Ambrose *et al.* 2007. *A Handbook of Biological Investigation*
Selected literature relevant to topic of individual research interest.

Week 5 Field trip 2; classes and activities on location.
Topic 5: Independent Research Refinement, part 1. Students work to refine their ideas and methods for independent research, and practice communicating their research plans.

Activities:

Small-group discussions and critiques of independent research ideas and field techniques.

Evaluations:

Participation (small-group discussions/critiques)

Week 6 Field trip 2; classes and activities on location.
Topic 6: Independent Research Refinement, part 2. Students work to refine their ideas and methods for independent research, and practice communicating their research plans.

Activities:

Small-group discussions and critiques of independent research ideas and field techniques.

Evaluations:

Participation (small-group discussions/critiques)



Week 7 Topic 7: Experimental Design (lecture). Students are taught about common designs in field research, and the corresponding statistical analyses

Activities:

Students select experimental design for their chosen research question and discuss design one-on-one with advisor.

Readings:

Selected literature relevant to topic of individual research interest.

Topic 8: Writing formal scientific proposals (lecture). Students are taught how to write a formal research proposal for a scientific audience.

Activities:

Students work independently to write a formal proposal according to guidelines. Students gather supplies, prepare equipment or set up experiments.

Evaluations:

Proposal

Readings:

Ambrose *et al.* 2007. *A Handbook of Biological Investigation*

Selected literature relevant to topic of individual research interest.

Week 8 Topic 9: Data collection in the field. Students work independently to collect data in the field

Activities:

Students spend a minimum of 4 hours/day (M-F) in the collection of data. Students meet one-on-one with advisor to show progress and outline goals.

Evaluations:

Participation (weekly progress report to advisor)

Readings:

Selected literature relevant to topic of individual research interest.



Week 9 Topic 10: Data collection in the field, part 2. Students work independently to collect data in the field, with revisions according to instructor's advice

Activities:

Students spend a minimum of 4 hours/day (M-F) in the collection of data. Students meet one-on-one with advisor to show progress and outline goals.

Evaluations:

Participation (weekly progress report to advisor)

Readings:

Selected literature relevant to topic of individual research interest.

Week 10 Topic 11: Data collection in the field, part 3. Students work independently to collect data in the field, with revisions according to instructor's advice

Activities:

Students spend a minimum of 4 hours/day (M-F) in the collection of data. Students meet one-on-one with advisor to show progress and outline goals.

Evaluations:

Participation (weekly progress report to advisor)

Readings:

Selected literature relevant to topic of individual research interest.

Week 11 Topic 12: Data collection in the field, part 4. Students work independently to collect data in the field, with revisions according to instructor's advice

Activities:

Students spend a minimum of 4 hours/day (M-F) in the collection of data. Students meet one-on-one with advisor to show progress and outline goals. Students may begin to enter data into spreadsheets.

Evaluations:

Participation (weekly progress report to advisor)

Readings:

Selected literature relevant to topic of individual research interest.

Week 12 Topic 13: Data entry, statistics, analysis, preparation of figures and tables.

Activities:

Students are coached individually on how to enter data, run statistics and analyses, and how to prepare data in figures and tables. Students enter data, run analyses, and create figures and tables.



Readings:

Ambrose *et al.* 2007. *A Handbook of Biological Investigation*

Topic 14: Writing a Scientific Manuscript (lecture). Students are informed on the content, style, and other general expectations for preparing a written scientific report.

Activities:

Students write their first submission of the scientific manuscript.

Readings:

Selected literature relevant to topic of individual research interest.

Week 13

Topic 15: Preparation for a professional seminar; preparing and editing manuscripts for submission

Lecture: "How to Make a Symposium Talk." Students are informed on the content, style, and other general expectations for preparing a talk for a scientific conference.

Activities:

Students prepare their individual presentations for the symposium.

Evaluations:

First submission of manuscript

Topic 16: How to review a scientific manuscript.

Activity:

Students read a peer's manuscript and write critical feedback.

Evaluations:

Peer review

Week 15

Topic 17: Symposium Presentations

Activity:

Independent preparation and delivery of talk, plus question-answer session. Students prepare and deliver their PowerPoint presentations to an audience of peers and members of the Monteverde community in a symposium similar to a scientific conference.

Topic 18: Revising manuscripts

Activity:



Students are instructed on how to use written feedback on first submission of manuscript to inform the preparation of the talk, and how to prepare for audience questions.

Evaluations:

Symposium presentation.

Final submission of manuscript.

Readings

The textbook for this class is:

Ambrose III, H.W., Ambrose, K. P., Emlen, D. J., & Bright, K. L. (2007). *A Handbook of Biological Investigation, 7th edition*. Hunter Textbooks, Inc., Winston Salem, N.C.

Additionally, students read and employ peer-reviewed literature related to their area of research interest for their proposals and manuscripts.