

**ASSOCIATED COLLEGES OF THE MIDWEST
COSTA RICA**

**NEOTROPICAL BIODIVERSITY AND
CONSERVATION**

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Introduction

Students from North America are at least somewhat familiar with many of the plants and animals of the north temperate region, but are generally much less familiar with the flora and fauna of tropical America (the Neotropics). Most of Latin America lies within the Neotropical region – southern Mexico, Central America, the Caribbean islands, and much of South America. The seven countries of Central America occupy a relatively small area (about three quarters the size of Texas), yet they harbor a biodiversity comparable to that of North America. For example, Costa Rica alone has more species of birds than the entire area north of the Rio Grande. This rich biodiversity results from the country's tropical climate, mountainous terrain, and its position as a land bridge between North and South America. Unfortunately, we are presently witnessing an unprecedented loss of biodiversity, a problem that is especially severe in those parts of the world harboring the greatest biodiversity, i.e. the tropics.

The loss of tropical biodiversity has many causes: an increasing human population, increasing rates of per capita consumption, economies that are heavily dependent upon the exploitation of natural resources, lack of long term planning, economic calculations that fail to include environmental costs, etc. Less than one quarter of Central America's original forests remains, and most of this loss has occurred in the last fifty years. Deforestation increases the rate of sedimentation in reservoirs that were constructed for hydroelectric power, resulting in increased costs of dredging and shortening the useful life of the reservoirs. Soil erosion also results in a loss of agricultural productivity. Marine ecosystems such as coral reefs and mangroves are being destroyed by overexploitation, land development in coastal areas, water pollution (e.g. agrochemicals), and climate change.

Despite the depressing statistics there is reason for guarded optimism since it is within our power to enact the necessary changes. However, viable solutions will require an awareness of the interconnected webs of causality, inputs from numerous disciplines, and new ways of thinking. Environmental problems and their solutions occur within the socio-economic-political framework of each country, but they are also affected by global processes. The subject matter of this course is very broad and there is an almost overwhelming amount of literature treating the sundry topics. We therefore need to develop the capacity to be selective.

Brief description of course

This course will examine the above topics, with special emphasis on Costa Rica. Various methods will be used to gain greater familiarity with the problems and possible solutions: presentations by the professor, reading selected papers, class discussions, and an individual research project. To better appreciate the region's rich biodiversity and the threats it is facing, the professor will highlight some basic natural history and scientific background in a manner understandable to non-biologists.

Goals and expected outcomes

The principal goals of this course are to become familiar with the incredible diversity of plants and animals occurring in Costa Rica (and the Neotropics in general), to understand the threats that this biodiversity is facing, and to obtain the necessary background information and thinking skills necessary for understanding the roots of the problems and hence their possible solutions. Since environmental degradation affects the economies and policies of Latin American countries, the subject matter of this course is important for a broader understanding of the region. By the end of the course it is expected that the student will have a preliminary knowledge of the region's biodiversity (and hopefully an interest in continuing to learn more about it), familiarity with some of the more important literature, and an ability to critically analyze these complex topics (e.g. how to distinguish scientific information from the misinformation promulgated by special interests).

Course assignments

Organism of the week

Each week you are encouraged to bring photos or describe plants and animals that you have seen in Costa Rica so that we can briefly discuss some local biodiversity at the beginning of each class. We will also take short walks around the UCR campus to help you become familiar with the local plants and animals.

Readings and discussions

For the first few weeks I will provide background information on some topics relevant to the course. The remaining class periods will be devoted to group discussions of specific topics, based on articles and book chapters that we will all read before class. Please come to each class having read the material scheduled for that day, preferably with notes and questions. Several of the readings will come from Lester Brown's book, *Plan B 4.0 Mobilizing to Save Civilization*, which is available online. You are encouraged to consult additional literature related to each discussion topic (use the ACM library and online resources). Finally, you will read *Natural Capitalism* and turn in a book report (try to grasp the essential ideas and avoid becoming bogged down in details).

Class attendance

Punctual attendance is obligatory at all scheduled class meetings. Absence due to medical reasons requires appropriate documentation. Other absences will be referred to the director.

Individual research project

The research project can be on topic of your choice, provided it is relevant to the subject matter of the course and is feasible. The project should include a combination of literature review (each student is required to read at least some literature written in Spanish), interviews, visits to relevant localities, etc.. Ideas for projects will arise during our class discussions and you should begin thinking about a research topic as soon as possible. **You have relatively little time to do this project!** Each student is required to turn in a research outline and proposal (see below). Throughout the semester there will be time at the end of each class for consultation. I will attempt to answer any questions you

may have, help guide you in your research project, and provide background readings (where possible), suggestions for the preparation of your oral presentation and final paper, etc.

Course evaluation

20% – Participation in class discussions.

30% – Written book review of *Natural Capitalism* (3-4 pages, single spaced)

10% – Oral presentation of research project.

40% – Final paper on research project. A standard way of organizing the paper is: introduction, methods, results, discussion, and bibliography. This should be a minimum of 15-20 pages, single spaced, excluding the bibliography.

Schedule

Note: The list of readings given below is provisional: a few substitutions and/or additions may be made (at least one week in advance). For each topic students are encouraged to provide additions to the list of readings.

Weeks 1-3. Presentations by the professor: Biodiversity, extinction, invasive species, biological control.

Week 4. Stabilizing population and eradicating poverty. Research outline due.

Readings: Chapters 6 & 7 in book by Lester Brown (see above)

Week 5. Protected areas. Research proposal due.

Readings:

Chan, K.M.A. & Daily, G.C. 2008. The payoff of conservation investments in tropical countryside. *Proceedings of the National Academy of Sciences* 105: 19342-19347.

Gaston et al. 2008. The ecological performance of protected areas. *Annual Review of Ecology, Evolution and Systematics* 39: 93-113.

Joppa, L.N., Loarie, S.R. & Pimm, S.L. 2008. On the protection of “protected areas”. *Proceedings of the National Academy of Sciences* 105: 6673-6678.

Weeks 6-8. No class (rural stay).

Week 9. Environmental values and education.

Readings:

Dietz, T., Fitzgerald, A. & Shwom, R. 2005. Environmental values. *Annual Review of Environmental Resources* 30: 335-372.

Guier et al. 2004. Educación ambiental en Costa Rica: tendencias evolutivas, perspectivas y desafíos. *Biocenosis* 18: 1-25.

Week 10. Nature recreation, ecotourism, and parks.

Readings:

Dasenbrock, J. 2002. The pros and cons of ecotourism in Costa Rica. *TED Case Studies* 12(1): Number 648 <http://www1.american.edu/ted/costa-rica-tourism.htm>

Menkhous, S. & Lober, D.J. 1996. International ecotourism and the valuation of tropical rainforests in Costa Rica. *Journal of Environmental Management* 47: 1-10.

Week 11. Water quality: freshwater and coastal. Book review due.

Readings:

Fallas, J. Evaluación de la vulnerabilidad a la contaminación del agua subterránea en Costa Rica: Una aproximación utilizando el modelo DRASTIC y sistemas de información geográfica

Mora Alvarado, D.A. 2009. Calidad sanitaria de las aguas de playa Jacó. Costa Rica 1986-2008. *Rev. Costarr. Salud Pública* 18: 5-9.

Week 12. Agriculture and fisheries.

Readings:

Chapters 8-9 in book by Lester Brown

Pauly, D. & Watson, R. 2003. Counting the last fish. *Scientific American* 289 (1): 34-39.

Stocking, M.A. 2003. Tropical soils and food security: The next 50 years. *Science*, 302: 1356-1358.

Week 13. Climate change and energy use.

Readings:

Chapters 11-12 in book by Lester Brown

Colwell, R.K., Brehm, G., Cardelús, C.L., Gilman, A.C. & Longino, J.T. 2008. Global warming, elevational range shifts, and lowland biotic attrition in the wet tropics. *Science* 322: 258-261.

Week 14. Designing cities for people and nature.

Readings:

Chapter 10 in book by Lester Brown

Week 15. Oral presentation of research projects. Final paper due.

GUIDELINES FOR THE RESEARCH PROPOSAL & PROJECT

The research proposal, although not subject to evaluation, is very important in helping you plan your project and providing you with a foundation upon which to write your final paper. Try to include most of the following items.

1. Title. It doesn't matter if the title changes during the course of your research. Providing a preliminary title helps define your question.

2. The question. Preferably there should be one main question, which can then be broken down into several smaller questions. Distinguish between the most relevant questions and those that are more peripheral. You may want to begin with more questions than you can answer – as you progress you can decide which ones are most feasible.

3. Importance of your project. Why will your research be valuable to you and to anyone who reads your final paper? In what way will it be new and different from existing information (e.g. previous ACM projects)?

4. Background information. Cite information that is relevant to your research question (publications, information from web sites, previous ACM projects, etc.). You will undoubtedly encounter more information as your project progresses, but it is useful to have at least something to help guide your research and assist you in your search for additional information.

5. Methods. How do you propose to go about answering your question? Bibliographic research? Interviews? Direct observations? Most projects will probably involve some combination of these. You may want to check out the logistics beforehand by doing a trial run. There are practical limitations on doing research far from San José.

6. Contents. This will probably change over the course of your project, but it is useful to have an idea of how you plan to organize your paper. (The organization of your oral presentation will probably be somewhat different, for example by emphasizing particularly interesting results and those that are most amenable to audiovisual presentations, and deleting details that are best presented in the written version.)

7. Bibliography. Your final paper should include a bibliography in a standardized format. It need not be exhaustive, but rather representative. Try to emphasize published references (ACM & UCR libraries, pdf versions of publications on the internet). When using unpublished information from the internet attempt to judge the quality of the information you find.