UNC GLOBAL

THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

COLLEGE OF ARTS & SCIENCES

STUDY ABROAD OFFICE

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Administrative Board of the College of Arts & Sciences
Office of General Education
CB # 3510
300 Steele Building
UNC-CH

Dear Colleagues:

The Center for Galapagos Studies, the Institute for the Environment and the Study Abroad Office are seeking your approval for a proposal to establish a summer study abroad program in the Galapagos Islands, Ecuador, beginning in 2011. This program is being organized in collaboration with the Universidad San Francisco de Quito (USFQ) and the Galapagos Instituto for the Arts & Sciences (GAIAS). Information about USFQ and GAIAS can be found at:
http://www.usfq.edu.ec/Paginas/Default.aspx

Universidad San Francisco de Quito
The program's academic base will be the Universidad San Francisco de Quito, a private, non-profit liberal arts university. Founded in 1988 by a group that included a UNC alumnus (Santiago Gangotena, PhD Physics), USFQ has quickly become the premier university in Ecuador. Its faculty members hold roughly half the doctoral degrees in Ecuador, and in 2009 it was ranked first among Ecuadorian universities based on the number of peer-reviewed scientific publications. USFQ is committed to international education, each year hosting approximately 700 international students, of which approximately 300 are from the United States. USFQ is a UNC Study Abroad-approved host for both semester exchange and summer programs.

USFQ's Galapagos Academic Institute for Arts and Sciences (GAIAS) on Isla San Cristobal in the Galapagos will be the primary host for this program. GAIAS was established in 2002 as an academic and research campus for international students as well as students from the Galapagos and the Ecuadorian mainland. They host a variety of

semester and summer exchange programs in collaboration with 45 partner institutions in North America, Europe, and Asia. The GAIAS campus is located in Puerto Baqueno, the seat of government in the Galapagos, and fronts directly on to the bay. Facilities include classrooms, computer labs, and outdoor facilities for marine classes and equipment. Direct flights are available from the mainland to San Cristobal.

This proposal was developed by Steve Walsh and Phil Page (Center for Galapagos Studies), Greg Gangi (the Institute for the Environment) and Rodney Vargas (Latin American Programs Director of UNC at Chapel Hill Study Abroad). Mr. Vargas conducted a site visit in February of 2010 to meet with USFQ faculty and staff and review the logistical arrangements for the program.

Program Structure and Content

This proposal is for a two-course study abroad program based in Ecuador, primarily in the Galapagos islands, to be hosted by the Universidad San Francisco de Quito's Galapagos Institute for the Arts and Sciences (GAIAS). Starting in Quito for the first week and then to GAIAS in the Galapagos archipelago for the bulk of the six week program, the students will follow an environment, ecology, and ecological methods curriculum that combines classroom, field, and lab learning. The program will consist of two 3-unit courses plus Spanish language instruction, and will serve 15-20 undergraduate students.

For the 2011 offering of the courses, students will be awarded graded credit from UNC. One of the three credit courses will be **Contemporary Topics in Geography & Special Topics in Environmental Science and Studies** (GEOG 399/ENST 490), and the other will be **Marine Ecology** (BIOL 462/MASC 440). The human ecology course will be taught by USFQ faculty member Dr. Greg Gangi (instructor of record) of the UNC Institute of the Environment and Dr. Carlos Mena. The marine ecology course will be taught by UNC faculty member Dr. John Bruno (instructor of record), and USFQ faculty Dr. Judith Denkinger and Dr. Luis Vinueza.

Please see Appendices 1 and 2 for the proposed schedule and syllabi for the Summer 2011 courses. The human ecology course will have 45 contact hours, and the marine ecology course will have 49.

A number of Galapagos environment and ecology courses are included in the proposal for this program, with the expectation that the courses will rotate during subsequent summers to allow for a greater variety of course topics and faculty involvement, and hopefully draw from a broad array of Carolina students. In addition to the human and marine ecology courses for Summer 2011, the roster includes the following courses and possible instructors/co-instructors:

- Human-Environment Interactions in the Galapagos Islands (GEOG 269). Stephen J. Walsh (UNC), Gabriela Valdivia (UNC), Diego Quiroga (USFQ)
- Marine Ecosystem-Based Management (ENST 490). Geoffrey W. Bell (UNC)

- Humans and Their Microbiological Footprint (ENST 490). Rachel T. Noble (UNC)
- Oceanography of the Eastern Tropical Pacific Ocean and Galapagos Islands (ENST 490). Thomas Shay (UNC)
- Geographic Information Systems (GEOG 491). Stephen J. Walsh (UNC), Philip H. Page (UNC), Carlos Mena (USFQ)
- Sustainable Tourism (ENST 490). David Salvesen (UNC)

Please see Appendix 3 for the syllabi for possible future (2012-) offerings of the program.

In cases where a course is co-taught by a USFQ instructor, UNC faculty will be the instructor of record. Please see Appendix 4 for the CVs for non-UNC faculty.

In addition to the two primary courses, Students will receive twenty contact hours of non-credit, classroom-based Spanish "survival" language instruction, plus Spanish language practice with their host families at GAIAS, on Isla San Cristobal in the Galapagos. The classroom Spanish instruction will be provided by faculty from USFQ's Institute for Languages.

The program will include field trips and shorter excursion to a variety of sites in the Galapagos, and classroom and field visits with people involved in local conservation and ecological issues such as fishermen, resource managers, and local scientists. These activities will be a part of formal course activities and will provide illustrations and/or demonstrations of course conceptual or factual content.

Rationale for the Program

This program offers a rigorous academic learning opportunity in one of the world's most important ecological sites: the Galapagos archipelago. The two courses will cover human and marine ecology in settings that have been crucial to the history of the ecological sciences, and where pressing conservation and ecology debates and science are currently taking place.

This program will also be an important component of the ongoing and growing ties between UNC and USFQ. UNC and USFQ are jointly developing a Galapagos Initiative that grew out of research collaboration in the Galapagos between faculty at the two universities, and UNC has established the Center for Galapagos Studies to manage its activities in the archipelago. Multiple research projects are underway in the Galapagos, most involving both UNC and USFQ faculty. UNC graduate students from a number of departments are working on thesis and dissertation research there, and during the summer of 2009 one UNC undergraduate student participated in field data collection for a research project funded by UNC's Institute for Global Health and Infectious Disease.

Most importantly, as a part of this Galapagos Initiative, UNC and USFQ are about to begin construction on a jointly-managed research facility on Isla San Cristobal in the Galapagos that will be a tremendous resource for future capstone courses, honors theses,

and other opportunities for undergraduate research projects. The faculty collaboration and logistical experience from this summer 2011 course will provide and ideal springboard for the development of future undergraduate learning experiences in the Galapagos.

Rationale for the Galapagos Islands

The Galapagos Islands are a living laboratory for the study of ecology, environmental change, and the conflicts between nature and society. Free of humans and predators for almost all of its history, these "Enchanted Islands" have developed some of the most unique life forms on the planet, highly adapted to their surroundings and living in ecological isolation from the rest of the world. Charles Darwin's famous visit in 1835 and his subsequent development of the theory of natural selection brought attention to the islands. Since then, the importance of the islands has been recognized by a series of protections and designations: in 1959, the Galapagos National Park was formed, and UNESCO designated the Galapagos as a World Heritage Site in 1978, a designation to honor the "magnificent and unique" natural features of the Galapagos and to ensure their conservation for future generations. These islands were further deemed a Biosphere Reserve in 1987, and the Galapagos Marine Reserve was created in 2001.
Today, the Galapagos Islands are in a period of rapid change and growing crisis.

Beginning in the 1970s, they began to draw thousands of new residents, attracted by the promise of employment opportunities in construction, fisheries, and tourism linked to the islands' rich marine and terrestrial ecosystems. Development of the tourism industry and a boom in fishing more than tripled the local population in the past 15-years. The number of tourists visiting the Islands has quadrupled over the same period and is now approaching 200,000 per year. This expanding human imprint on the islands has contributed to (1) over-use of natural resources; (2) replacement of native and endemic species by invasive flora and fauna; (3) extraction of marine resources at unprecedented rates; (4) expansion of tourism and associated development into increasingly fragile marine and terrestrial environments; (5) a dramatic increase in human energy consumption and waste generation; (6) conflicts between resource conservation, economic development, and sustainable communities; and (7) considerable stress on the social, terrestrial, and marine subsystems of the islands. Recognizing these threats, in June 2007, UNESCO declared the Galapagos Archipelago an endangered World Heritage Site, and similarly, the Ecuadorian Government declared an "ecological emergency" for the islands.

The special characteristics that have made the Galapagos so important to science since the 19th century will provide an ideal environmental laboratory for students in this program, while the increasing human pressure in the Galapagos will serve to illustrate the complex linkages between economic development and the environment.

Program Requirements, Availability, and Size

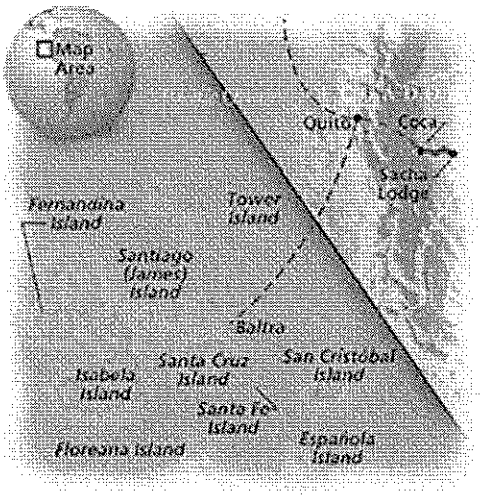
The program will first be offered during the summer of 2011 and it will run for almost seven weeks, from late June to mid-August. It is expected that this program will be offered every summer in the future, though the dates for the program may vary somewhat from year to year

The minimum GPA will be 2.75. The maximum number of students who can be accepted in the program is 20, based on limitations related to managing the field excursions, some of which will require boat travel.

This program has no prerequisites. Prior knowledge of Spanish will be useful, but is not required for enrollment. Faculty and support staff at USFQ and GAIAS speak English, and classes will be conducted in English.

Student Accommodation and Resources
Students will initially stay in homestays near the USFQ campus in Quito while studying at USFQ.

The remainder of the program will be held in the Galapagos, primarily at the GAIAS campus in Puerto Baquerizo Moreno on Isla San Cristobal, with short stays on Isla Santa Cruz and Isla Isabela. On San Cristobal, students will be housed with families selected by GAIAS to host homestays, and the host families will provide breakfast and laundry services. On Santa Cruz and Isabela, students will be housed in hotels, with breakfast included. On each of the islands in the Galapagos there are restaurants within easy walking distance, most of which will have vegetarian options available on the menu or by request.



Puerto Baquerizo Moreno has a post office, several internet cafes, an international telephone calling center, banks (with ATMs), travel and tour agencies. Groceries are available for purchase at several small tiendas and bodegas. The students will visit Puerto Ayora on Santa Cruz and Puerto Villamil on the trips. Puerto Ayora is the largest town in the Galapagos with a similar set of facilities to Puerto Baquerizo Moreno. Puerto Villamil has a more limited set of facilities; the most notable difference from the other two towns being that it has no ATM, but the short duration of the visit here should ensure this is a minimal problem.

GAIAS maintains a small library in its classroom building in Puerto Baquerizo Moreno, and also provides free, wireless internet access for student laptops and smartphones.

It is possible to purchase an inexpensive (~US$30) cellular phone in Quito or the Galapagos (vendors: Porta and Movistar) that can be used to call both within Ecuador and to the US at reasonable rates.

All travel and transportation within Ecuador and the Galapagos will be arranged by USFQ and GAIAS staff.

Safety and Security
The Galapagos Islands as a whole are a very safe environment. The populated islands (Santa Cruz, San Cristobal, and Isabela) all have a "small town" atmosphere with few opportunities for students to become isolated and no dangerous neighborhoods. Students are accompanied by tour and GAIAS staff on any field excursions. During the preliminary period in Quito, students will of course be located in a major South American metropolitan area. However most of Quito is relatively safe and the USFQ hosts are experienced in ensuring foreign students are aware of acceptable areas of travel.

All of the islands to be visited by the students have both public and private health clinics. In addition, Puerto Baquerizo Moreno and Puerto Ayora have small hospitals, and a major provincial-level hospital is currently under construction in Puerto Baquerizo Moreno, with construction possibly to be complete by Summer 2011, but definitely by Summer 2012.

We hope this proposal has given a clear representation of the summer study abroad program that we wish to offer in 2011 and thereafter every year. The Center for Galapagos Studies, the Institute for the Environment and the Study Abroad Office are excited by the potential opportunity presented and we hope the Administrative Board will give this proposal all serious consideration. We are happy to provide you will any addition information, if you desire, to aid in your evaluations of this proposal.

Sincerely,

Stephen J. Walsh
Director, Center for Galapagos Studies

Lawrence Band
Director, Institute for the Environment

Robert Miles, PhD.
Associate Dean for Study Abroad and International Exchanges

Appendix 1

Summer 2011 Proposed Schedule

Schedule

DAY	DATE	LOCATION	ACTIVITY	CONTACT HOURS	
				Course	Spanish
Sunday	June 26	Arrival Date	Travel		
Monday	June 27	USFQ Quito	Orientation at USFQ		
Tuesday	June 28	Quito	City Visit & Mitad del Mundo		
Wednesday	June 29	USFQ Quito	**Human Ecology Course begins:** AM CLASS / PM CLASS	3	
Thursday	June 30	USFQ Quito	AM Class/ PM Class	3	
Friday	July 1	USFQ Quito	AM Class/ PM Class	3	
Saturday	July 2	Otavalo	Otavalo		
Sunday	July 3	Free Day	FREE DAY		
Monday	July 4	Leave for San Cristobal	Travel/ Orientation (Town Tour)		
Tuesday	July 5	GAIAS	AM Class/ PM Class	3	1
Wednesday	July 6	GAIAS	AM Class/ PM Class	3	1
Thursday	July 7	GAIAS	El Junco+Galapaguera+El Progreso / Class	3	
Friday	July 8	GAIAS	AM Class/ PM Class	3	1
Saturday	July 9	GAIAS	FREE DAY		
Sunday	July 10	GAIAS	FREE DAY		
Monday	July 11	GAIAS	AM Class/ PM Class	3	1
Tuesday	July 12	GAIAS	Agricultural Zone Excursion / Class	3	
Wednesday	July 13	GAIAS	AM Class/ PM Class	3	1
Thursday	July 14	GAIAS	AM Class/ PM Class	3	1
Friday	July 15	GAIAS	AM Class/ PM Class	3	1
Saturday	July 16	GAIAS	FREE DAY		
Sunday	July 17	GAIAS	FREE DAY		
Monday	July 18	GAIAS	AM Class/ PM Class	3	1
Tuesday	July 19	GAIAS	AM Class/ PM Class	3	1
Wednesday	July 20	GAIAS	AM Class/ PM Class	3	1
Thursday	July 21	GAIAS	**Marine Ecology Course Bgins:** AM CLASS / PM CLASS	3	1
Friday	July 22	GAIAS	AM Class/ PM Class	3	1
Saturday	July 23	Free Day	FREE DAY		
Sunday	July 24	GAIAS Isabela	Day Tours Begin: Isabela	2	
Monday	July 25	Isabela	Isabela	2	
Tuesday	July 26	Isabela	Isabela	2	
Wednesday	July 27	Isabela-Santa Cruz	Isabela-Santa Cruz	2	

Thursday	July 28	Santa Cruz	Santa Cruz	2	
Friday	July 29	Santa Cruz-GAIAS	Day Trip (Seymour, Bartolome)	2	
Saturday	July 30	Santa Cruz-GAIAS	Transfer back to San Cristobal		
Sunday	July 31	GAIAS	FREE DAY		
Monday	August 1	GAIAS	AM Class/ PM Class	3	1
Tuesday	August 2	GIAS	AM Class/ PM Class	3	1
Wednesday	August 3	GAIAS	AM Class/ PM Class	3	1
Thursday	Agust 4	GAIAS	**Kicker Rock & Isla Lobos** / Class	5	
Friday	August 5	GAIAS	AM Class/ PM Class	3	1
Saturday	August 6	GAIAS	FREE DAY		
Sunday	August 7	GAIAS	FREE DAY		
Monday	August 8	GAIAS	AM Class/ PM Class	3	1
Tuesday	August 9	GAIAS	**La Loberia** / Class	5	
Wednesday	August 10	GAIAS	AM Class/ PM Class	3	1
Thursday	August 11	GAIAS	AM Class/ PM Class	3	1
Friday	August 12	GAIAS	FREE DAY		1
Saturday	August 13	GAIAS-Quito	Travel back to Quito		
Sunday	August 14	Quito	Farewell Dinner		
Monday	August 15	Back to the US	Travel		
			Total Contact Hours:		
			Human Ecology	45	
			Marine Ecology	49	
			Spanish	20	

Appendix 2

Summer 2011 Proposed Syllabi

Contemporary Topics in Geography & Special Topics in Environmental Science and Studies (GEOG 399/ENST 490)

Institute for the Environment, University of North Carolina at Chapel Hill
Galapagos Institute for the Arts and Sciences, Universidad San Francisco de Quito

Quito & Galapagos, Ecuador

Instructors

Greg Gangi, Ph.D.
ggangi@email.unc.edu
University of North Carolina at Chapel Hill

Carlos F. Mena, Ph.D.
cmena@usfq.edu.ec
Universidad San Francisco de Quito
University of North Carolina at Chapel Hill (adjunct)

Diego Quiroga, Ph.D.
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University of North Carolina at Chapel Hill (adjunct)

Description of the course

This class explores the complex links between society and nature. Human Ecology will analyze a collection of ideas, approaches, and methods that based on political economy, ecosystem science, and peasant studies challenge the notion that environmental problems are created by simple causal mechanisms. This class questions how management practices, political and economic structures, and ecosystems are connected to produce different ecological patterns and socioeconomic processes, for example, deforestation or types of access and control over the resources. The objective of this class is, using a theoretical toolkit, case studies, and qualitative methods, to obtain a deeper understanding of the relationships between poverty and environment, and the role of conservation efforts, in shaping these relationships.

We will explore the diversity of Ecuador by working in Quito, a visit to the Otovalo cultural area near Quito, (enrichment only – no instruction), and of course the urban, highland, and agricultural areas of Isla San Cristobal in the Galapagos. All these contrasts will allow us to explore ecological and social concepts central to this course. As we experience live examples of evolution towards endemism or extreme diversity, we will also try to understand how humans relate to these resources and how we may threaten their future. Students will have the opportunity to work on a small project to test the theoretical concepts learned in class.

Required Books:
These books should be read before the start of the trip. The first book will put the topic of the course into a broader global context and then during the trip we will explore this topic through the lens of what is happening in Ecuador and especially in the Galapagos.

Roe, Dilys and Elliot, Joanna eds. (Due out March 2010) The Earthscan Reader in Poverty and Biodiversity Conservation. (Earthscan Publications)

Wilson, Edward O. 1999. The Diversity of Life (W.W. Norton & Co.: NY)

Course contents and schedule

Contact Day	*Date*	*Topic*	*Location*	*Contact Hours*
1	June 29	Basic Concepts: The Many Roads to Conservation	USFQ	3
2, 3	June 30, July 1	Natural Science and Conservation	USFQ	3
4	July 5	Local people and Conservation	San Cristobal	3
5	July 6	Ecuador: Colonization, agricultural frontiers and deforestation	San Cristobal	3
6	July 7	Excursion to Highlands; Habitat loss and Degradation	San Cristobal	3
7	July 8	The Galapagos Case: Protected Areas and Conservation	San Cristobal	3
8	July 11	Patterns of Extinction	San Cristobal	3
9	July 12	Midterm exam; Excursion to Agrigultural Zone	San Cristobal	3
10	July 13	Biodiversity	San Cristobal	3
11	July 14	Trip to Leon Dormido/ The Human Impact on the Galapagos Marine Resource	San Cristobal	3
12	July 15	Poverty, Land Tenure and Environment	San Cristobal	3
13	July 18	Prospects of the Conservation and Development in Galapagos	San Cristobal	3
14	July 19	Exam and Final Project Presentation	San Cristobal	3
15	July 20	Future trends: critiques and new perspectives	San Cristobal	3

Total: 45 contact hours

Course strategy, assignment and grading

- This course uses active learning approaches (e.g., interactive lecturing, teacher/student lead discussions, in-class writing, case studies, debates, etc.) which will help you to "think critically" about environmental problems.

- There will be two tests (essay type), a midterm exam to be taken in class and a final exam or final project to be developed during the class. The tests will cover discussion papers, study cases, and fieldwork reports.
- Each student is expected to present and lead the discussion of a paper at least once during the cycle.
- All the class is expected to participate in the discussion.
- During this module, a fieldtrips will be made to analyze the situation of the fisheries and tourism in San Cristobal.
- There will be a short final project (groups of two students) where groups will be in charge of selecting an specific environmental problem and analyze it in light of Political Ecology concepts.
- Grading is divided as: Class participation 30%, article presentation 20%, midterm exam 15%, report of fieldtrip 15%, final project 20% (10% written report, 10% oral report).
- Grading scale: A=100-91, B=90-81 , C=80-71, D=70-61, F=<60

Course readings

Day 1: Basic Concepts: The many roads to conservation

Borgerhoff Mulder, M. & Cappolillo, P. 2005. Chapter 1: The Many Roads to Conservation in Conservation Linking Ecology, Economics and Culture. Princeton University Press. Princeton, NJ.

Day 2 & 3: Natural Science and Conservation

Wilson, Edward O. 1999. Chapter 8-10

Borgerhoff Mulder, M. & Cappolillo, P. 2005. Chapter 4: Indigenous People as Conservationist in Conservation Linking Ecology, Economics and Culture. Princeton University Press. Princeton, NJ.

Day 4: Local People and Conservation

Rudel TK; Bates D, Machinguiashi, R. 2002. A Tropical Forest Transition? Agricultural Change, Out-migration, and Secondary Forests in the Ecuadorian Amazon. Annals of the Association of American Geographers, Volume 92, Issue 1: 87 - 102

Jokisch B. 2002. Migration and Agricultural Change: The Case of Smallholder Agriculture in Highland Ecuador. Human Ecology, Vol. 30, No. 4, 523-550

Day 5: Ecuador: Colonization, Agricultural Frontiers and Deforestation

Wilson, Edward O. 1999. Chapter 11-15

Day 6: **Habitat Loss and Degradation**

Baine M, et al, 2007. Coastal and marine resource management in the Galapagos Islands and the Archipelago of San Andres: Issues, problems and opportunities. Ocean & Coastal Management 50: 148–173

Davos et al., 2007. Zoning of marine protected areas: Conflicts and cooperation options in the Galapagos and San Andres archipelagos Ocean & Coastal Management 50: 223–252

Day 7: **The Galapagos Case: Protected Areas and Conservation**

Wilson, Edward O. 1999. Chapter 1-3

Day 8: **Patterns of Extinction**

Fieldwork/Midterm

Day 9: **Mid-term exam and fieldwork in town (Puerto Baquerizo Moreno)**

Day 10: **Biodiversity**

Wilson, Edward O. 1999. Chapter 4-7

Day 11: **The Human Impact on the Galapagos Marine Resource and the Efforts to Preserve the Environment.**

Murillo et. al. Artisan Fishing in the Galapagos Comparison of Indicators 1997-2001

R.H Bustamente, Bensted Smith and G. J. Edgar. Status and Threats to Marine Biodiversity

Day 12: **Poverty, Land Tenure and Environment**

Gray and Moseley. 2005. A geographical perspective on poverty–environment interactions. The Geographical Journal, 171(1) 9–23

Lu Holt F. 2005. The Catch-22 of Conservation: Indigenous Peoples, Biologists, and Cultural Change. Human Ecology 33(2) 199-215

Hardin, G. 1968. The Tragedy of the Commons, Science, Vol. 162, No. 3859: 1243-1248

Day 13: **Prospects of Conservation and Development in Galapagos**

González, J. A., C. Montes, J. Rodríguez, and W. Tapia. 2008. Rethinking the Galapagos Islands as a complex social-ecological system: implications for conservation and management. Ecology and Society 13(2): 13

Quiroga, D. In Press. Crafting Nature: The Galapagos and the Making and Unmaking of a Natural Laboratory. Journal of Political Ecology

Day 14: **Exam and Final Project Presentation**

Day 15: **Future trends in the Human-Environment Research and Practice**

Grimm, N. B., S. H. Faeth, et al. (2008). "Global change and the ecology of cities." Science 319(5864): 756.

Young, O. R., F. Berkhout, et al. (2006). "The globalization of socio-ecological systems: an agenda for scientific research." Global Environmental Change 16(3): 304-316.

Shelton, D . 2008. Human Rights and the Environment: Problems and Possibilities. Environmental Policy and Law. Vol. 38, no. 1-2, pp. 41-49

Marine Ecology (BIOL 462/MASC 440)

Quito & Galápagos Islands, Ecuador
Professors: John Bruno (UNC), Judith Denkinger (USFQ), Luis Vinueza (UNC and USFQ)

Course Description

The course will provide a survey of the ecological processes that structure marine communities in a range of coastal habitats using the Galapagos Islands as a natural laboratory. Through classroom lectures, extensive readings, laboratory activities, field surveys and experiments we will explore a variety of marine communities of the Galapagos including mangrove forests, wetlands, rocky shores, subtidal communities and pelagic shallow water systems. Students will also gain knowledge of the identity, classification, life history and ecology of the plants, marine algae, invertebrates, fishes, birds and marine mammals that inhabit this diverse ecosystem. We will cover a variety of ecological processes, e.g., competition, predation, disturbance and relate these marine ecological processes and research in Galapagos habitats to related work in other tropical and subtropical systems. Finally, we will cover the conservation and management of populations and communities in the Galapagos Marine Reserve, in particular in response to climate change and overfishing.

The course will be based at the Galapagos Academic Institute for the Arts and Sciences (GAIAS) on San Cristobal Island in the Galapagos, with multiple, short field excursions to the bay directly outside the GAIAS classroom building and other sites on the island. The course will also include trips to the islands of Isabela and Santa Cruz, including a day trip to Isla Bartolome. Note that the excursions and trips *will* include course activity time for lectures, discussion, demonstrations, and field exercises, though time for recreation will also be provided.

Course Content

The Physical Environment
- Local upwelling and major ocean currents of the eastern Pacific
- The ENSO cycle in the Galapagos

Zoology
- Invertebrates and algae
- Galapagos fishes and sharks
- Marine birds, reptiles and mammals

Marine Ecology of key Habitats and Communities
- Mangroves and coastal wetlands
- Rocky intertidal and subtidal habitats
- Shallow pelagic environments

Ecological Processes
- Benthic pelagic coupling
- Species interactions
- Environmental disturbances

Conservation and Management

Climate change and ENSO; impacts on populations and ecosystems
Marine protected areas; the Galapagos Marine Reserve
Managing fishing and its impacts

Instructors

The course will be co-organized and co-taught by three marine ecologists; John Bruno, PhD (UNC), Judith Deckinger, PhD (USFQ), Luis Vinueza, PhD (UNC and USFQ). We will also likely include lectures by local scientists and marine resource managers.

Evaluation

Mid-course exam	20%
Final exam	30%
Field zoology ID exam	10%
Lab notebook	10%
Field lab/experiment write up	20%
Participation and Presentation	10%

Course Readings

There is no textbook for the class. All course readings will be available as PDF files which will be provided to the students. Course readings will include review chapters and papers on general topics and more detailed cases studies from the primary scientific literature. Field guides to marine animals and plants of the region will be provided to the students.

Course Contents And Schedule

Day	Date	Topics	Location	Contact Hours
1	July 21	Local upwelling and major ocean currents of the eastern Pacific	San Cristobal	3
2	July 22	The ENSO cycle in the Galapagos	San Cristobal	3
3	July 24	Mangroves and coastal wetlands	Isabela	2
4	July 25	Invertebrates and algae	Isabela	2
5, 6	July 26, 27	Rocky intertidal and subtidal habitats	Isabela	4
7	July 28	Galapagos fishes and sharks	Santa Cruz	2
8	July 29	Marine birds, reptiles and mammals	Santa Cruz (Bartolome)	2
9	Aug 1	Shallow pelagic environments	San Cristobal	3
10	Aug 2	Mid-term exam; Shallow pelagic environments	San Cristobal	3
11	Aug 3	Benthic pelagic coupling	San Cristobal	3
12	Aug 4	Species interactions & excursion to Kicker Rock/Isla Lobos	San Cristobal	5
13	Aug 5	Environmental disturbances	San Cristobal	3

14	Aug 8	Climate change and ENSO; impacts on populations and ecosystems	San Cristobal	3
15	Aug 9	Marine protected areas; the Galapagos Marine Reserve; managing fishing and its impacts & excursion to La Loberia	San Cristobal	5
16	Aug 10	Managing invasive species and their impacts on the Galápagos; Coastal development and mitigation strategies on the Galápagos	San Cristobal	3
17	Aug 11	Final exams including zoology ID test.	San Cristobal	3

Total contact hours: 49

Appendix 3

Additional Syllabi, Future Program Years

GEOG 269: Human-Environment Interactions in the Galapagos Islands

Stephen J. Walsh & Gabriela Valdivia
Department of Geography, University of North Carolina at Chapel Hill

Introduction

The Galapagos Islands are a "living laboratory" for the study of evolution, global environmental change, and the conflicts between nature and society. Free of humans and predators for almost all of its history, these "Enchanted Islands" have developed some of the most unique life forms on the planet, highly adapted to their harsh surroundings and living in ecological isolation from the rest of the world. It was not until Charles Darwin's famous visit in 1835, which helped inspire the theory of evolution by natural selection that this archipelago began to receive international recognition. In 1959, the Galapagos National Park was formed, and in 1973, the archipelago was incorporated as the 22nd province of Ecuador. UNESCO designated the Galapagos as a World Heritage Site in 1978, a designation to honor the "magnificent and unique" natural features of the Galapagos and to ensure their conservation for future generations. These islands were further deemed a Biosphere Reserve in 1987, and the Galapagos Marine Reserve was created in 2001. The Marine Reserve was formed as a consequence of the 1998 passage of the *Special Law for Galapagos* by the Ecuadorian government that was designed to "protect and conserve the marine and terrestrial resources of the Islands." The Galapagos archipelago encompasses 14 large islands and 200 small islands totaling approx. 8,010 sq. km. dispersed throughout an area of 70,000 sq. km.

Today, the Galapagos Islands are in crisis. Beginning in the 1970's, they began to draw thousands of new residents, attracted by the promise of lucrative opportunities linked to the islands' rich marine and terrestrial ecosystems and employment opportunities in construction, fisheries, and tourism. Development of the tourism industry and a boom in fishing more than tripled the local population in the past 15-years. The number of tourists visiting the Islands has quadrupled over the same period and is now approaching 200,000 per year. This expanding human imprint on the islands has contributed to (1) over-use of natural resources; (2) replacement of native and endemic species by invasive flora and fauna; (3) extraction of marine resources at unprecedented rates; (4) expansion of tourism and associated development into increasingly fragile environments; (5) a dramatic increase in human energy consumption and waste generation; (6) conflicts between resource conservation, economic development, and sustainable communities; and (7) considerable stress on the social, terrestrial, and marine sub-systems of the islands. Recognizing these threats, in June, 2007, UNESCO declared the Galapagos Archipelago an "endangered" World Heritage Site, and similarly, the Ecuadorian Government declared an "ecological emergency" for the islands.

The links between people and environment serve to frame the many conflicts between and among the various conservation and development sectors that have competing economic and environmental interests; conflicts historically exacerbated by a lax and unresponsive government. Historically, there have always been sectors of the local economy supported by agriculture, as well as by the fishing and tourism industries, but the rapid and seemingly uncontrolled increase in the economic drivers associated with fisheries and tourism over the last 20-years has exacerbated an already difficult and complex situation. For instance, economic diversification from agriculture to tourism has led to labor shortages on the farm and a demand for mainland immigrants, and a decline in management of invasive plant species has led to land abandonment and the threat of invasive species "escape" from human use zones to the National Park. The problem of invasive species illustrates the important feedbacks between the social and ecological systems: land management practices reflect human migration patterns and economic choices, whereby,

increasing urbanization linked to tourism and other opportunities renders land underutilized and abandoned.

Course Perspective

For scientific, as well as conservation, reasons, it is imperative to better understand the linkages among social, terrestrial, and marine sub-systems in the Galapagos Islands. Doing so requires working across traditional disciplinary boundaries. Thus, we will employ an interdisciplinary and multi-thematic approach to the study of the Galapagos and its coupled human-natural system. We will also view the Galapagos as an archipelago with unique and special settings and landscapes, but we will also view the Galapagos within the context of external connections and feedbacks within the context of globalization.

Globalization is not a new phenomenon, but it is posing new challenges to humans and natural ecosystems in the 21st century. From climate change to increasingly mobile human populations to the global economy, the relationship between humans and their environment is being modified in ways that will have long-term impacts on ecological health, biodiversity, and system sustainability. These changes and challenges are perhaps nowhere more evident than in island ecosystems. Buffeted by rising ocean temperatures and extreme weather events, islands represent both the greatest vulnerability to globalization and also the greatest scientific opportunity to study the impacts and significance of global changes. In this class, we bring together social, natural, and marine sciences to consider a new "Island Biocomplexity," one capable of understanding and meeting the challenges of the 21st century. Island Biocomplexity combines social-ecological co-evolution and adaptive resilience with a new island biogeography that incorporates human impacts to study coupled human-natural systems. Biocomplexity is described as the "properties emerging from the interplay of behavioral, biological, chemical, physical, and social interactions that affect, sustain, or are modified by living organisms, including humans" (Michener et al., 2003, p. 1018); it encompasses the complex interactions within and among ecological systems, the physical systems on which they depend, and the human systems with which they interact.

Course Questions

The Galapagos Islands are a highly dynamic system that provides a unique opportunity to understand complex social, terrestrial, and marine interactions. The primary question that will guide the course includes: ***How can the social and ecological sustainability of a coupled human-natural system be achieved in the Galapagos Islands and beyond?*** The primary changes we will address are: global climate changes (and attendant changes in resource stocks, weather patterns, and land use), demographic changes (including new flows of tourism, migrants, and endogenous population growth), economic changes (including the development of global markets for marine resources, tourism, and island agricultural goods), biophysical changes (including invasive flora and fauna and their influence on native and endemic species), and marine changes (including transformational effects of mangrove forests, marine ecology and species populations, and El Niño events and habitat dynamics). We will also examine the effects of global change and these changes in human societies in the islands and on terrestrial and marine ecosystems and the subsequent feedbacks to social and ecological parameters. The changes among these various subsystems are clearly linked, necessitating an interdisciplinary perspective.

Complementary questions include:

- What strategies can be developed that allow economic development and resource conservation to occur in a compatible and sustainable way that benefits people and environment?
- What are the explicit and implicit links, pattern-process relations, and dynamics between social, terrestrial, and marine sub-systems in the Galapagos Islands?
- What are the impacts of invasive flora and fauna on native and endemic species, habitat quality and dynamics, and the sustainability of households and communities?

- What integrative methods and interdisciplinary approaches can be used to address the critical system feedbacks between people and environment that occur in the Galapagos Islands?
- How can the study of coupled human-natural systems in the Galapagos Islands contribute to the broader understanding of resource conservation and economic development as a global template?

Course Organization

The class cover the same subject matter as when offered on-campus at UNC, but will include field excursions in the Galapagos to demonstrate course concepts and factual material.

Week 1 – "Living Laboratory" – Galapagos Islands & Social-Ecological Contexts

Readings

Stewart, P.D., Merlen, G., Morris, P., Murray, A., Stevens, J., Wollocombe, R. 2007. *The Islands that Changed the World*. Yale University Press.

Galapagos, a DVD, prepared by the BBC for the National Geographic Channel and aired in 2007 in the US.

Field Visits on San Cristobal Island, Galapagos Archipelago

Class 1 – Island Origins & Human Discovery (3 hours)

Class 2 – Darwin & Evolution (3 hours)

Class 3 – Life on Land, Survival on the Coast, Ocean Oasis (3 hours)

Class 4 – Conserving the Galapagos Islands (3 hours)

Class 5 – Galapagos: World's End (Paper #1) (3 hours)

Week 2 – "Plundering Paradise: Galapagos at the Crossroads"

Reading

Bassett, C.A. 2009. Galapagos at the Crossroads. National Geographic Society, Washington, DC.

Class 6 - Genesis; Discovery & Darwin; Environmental Degradation (3 hours)
Class 7 - Economic Conditions and Livelihoods; Institutions & Social Unrest (3 hours)
Class 8 - Environmental Protection; Politics and Governance (3 hours)
Class 9 - Social-Ecological Vulnerability, Resilience, and Sustainability (3 hours)
Class 10 - Future Scenarios of What Might be? (Paper #2) (3 hours)

Week 3 – "Integration & Synthesis of Social, Terrestrial, Marine Sub-Systems in the Galapagos Islands: the Science of Coupled Human-Natural Systems"

Readings

Epler, B. 2007. Tourism, the economy, population growth, and conservation in Galápagos. *Report to the Charles Darwin Foundation*, Galapagos Islands, Ecuador.

González, J. A., C. Montes, J. Rodríguez, and W. Tapia. 2008. Rethinking the Galapagos Islands as a complex social-ecological system: implications for conservation and management. *Ecology and Society* 13 (2): 13. (online) URL: http://www.ecologyandsociety.org/vol13/iss2/art13/

Heslinga, J. 2003. Regulating ecotourism in Galapagos: a case study of domestic –international partnerships. *Journal of International Wildlife Law and Policy*, 6: 57-77.

Kerr, S.A. 2005. What is small island sustainable development about? *Ocean & Coastal Management* 48: 503-524.

Miller, B.W., Breckheimer, I., McCleary, A.L., Guzman-Ramirez, L., Caplow, S.C., Jones-Smith, J.C., Walsh, S.J. In Press. Using stylized agent-based models for population-environment research: a case study from the Galapagos Islands. Population-Environment.

Scholte, P. 2003. Immigration: a potential time bomb under the integration of conservation and development. *Ambio*, 32(1): 58-64.

Viteri, C. and Chavez, C. 2006. Legitimacy, local participation, and compliance in the Galapagos *Marine Reserve. Ocean & Coastal Management*.

Wittemyer, G., Elsen, P., Bean, W.T., Burton, C.O., Brashares, J.S., 2008. Accelerated human population growth at protected area edges. *Science* 321: 123-126.

Class 11 – Protected Areas & Sustainable Development (3 hours)
Class 12 – Fisheries, Farming, Tourism & Population Migration (3 hours)
Class 13 – Population Migration, Institutions, and Governance (3 hours)
Class 14 – Dynamic Systems Modeling (3 hours)
Class 15 – Final Exam & Paper #3 (3 hours)

Course Requirements & Grades

This course will have the same requirements and grading structure as its normal UNC on-campus offering.

Class Activities	% of Final Grade
Final Examination	25%
Paper #1 – Site & Situation of the Galapagos	25%
Paper #2 – Challenges to a World Heritage Site	25%
Paper #3 – Integration & Synthesis	25%

ENST 490 Special Topics: Marine Ecosystem-Based Management

INSTRUCTOR

Geoffrey W. Bell, Ph.D.
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University of North Carolina at Chapel Hill

COURSE DESCRIPTION

During the past decade conservation efforts and natural resource management have undergone a major change in philosophy and direction. Traditionally these efforts have used top-down, expert-driven government regulations to conserve/manage single resources. We are now starting to realize that it may be more effective to engage local communities in sustainability efforts that manage whole ecosystems that contain natural resources. This new approach is known as ecosystem-based management but because it is such a new concept it is not clearly defined and means different things to different people. In this class we will explore the unique marine ecosystems of the Galapagos Islands, the ecological science behind ecosystem management as well as how Ecuadorian communities are implementing this approach.

The unique marine ecosystems of the Galapagos Islands are shaped by various geological, physical oceanographic, and ecological processes. In the first part of this course you will learn the basic principles of physical, chemical, geological, and biological oceanography while using the Galapagos Islands as a case study. This will give you an appreciation for how these island ecosystems have evolved and why they are so unique. In the second part of this course you will learn about the ecological science underlying the Ecosystem-Based Management approach. We will focus primarily on biodiversity and its importance for the proper structure and function of ecosystems. We will take fieldtrips in the Galapagos Islands to explore the diversity of life on these islands so you get a thorough understanding of why biodiversity is important for conservation and management. In the last part of this course you will learn the various tools and strategies that are used in ecosystem-based management. In this part of the course you will also get an appreciation for just how complex the management process is not from a scientific and societal perspective.

COURSE CONTENT AND SCHEDULE

Day	*Topic*	*Contact Hours*
Introduction to Marine Science		
1	Physical & Chemical Processes in the Oceans	4
2	The Ecosystem Concept & Marine Ecosystems in Ecuador	3
3	Ecological Processes in Marine Ecosystems	3
4	Snorkeling/Diving Field Trip to Galapagos Marine Reserve	4
Ecological Science behind Ecosystem Management		
5	Population Dynamics	3
6	Genetic Diversity	3
7	Species Diversity	3

8	Stability & Resilience	3
9	Landscape Ecology	3
10	Galapagos Island Wildlife tour	4
Ecosystem-Based Management in Practice		
11	Uncertainty & Complexity	3
12	Adaptive management	3
13	Monitoring & evaluation	3
14	Ecosystem Services	3
15	Marine Protected Areas	3

COURSE STRUCTURE

- **General:** This course is a combination of lecture and discussion. For each class period you will have a 50 min introductory lecture followed by a student-lead discussion of ~30-60 pages of required readings from a combination of textbook chapters and the scientific literature. You are expected to have read the material and come to class prepared to discuss the topic with the rest of the class. The first half of the course will be devoted to the science of ecosystem management and the second half to management.

- **Discussions:** Each discussion will be led by one student but all students are expected to come to class having read each article thoroughly and prepared to participate in the discussions (your grade will be dependent on your class participation). The discussion periods will be split as evenly as possible among students. Depending on enrollment, students may lead anywhere from 2-3 discussions during the semester. The format of the discussions is largely up to you. **Your role as the discussion leader is to facilitate an open exchange of ideas and questions from the rest of the class, <u>not to summarize the articles</u> (there's no need since everyone has read the articles). An effective facilitator does not do the majority of the talking rather he/she gets others to talk. I would suggest that you come to class with 3-5 open-ended questions that will stimulate the other students to talk which will in turn lead to additional but related discussion topics.** You are not expected to be an expert on the topic nor should you be someone who the other students turn to for answers about specific details in the readings they did not understand. If I feel that students are not adequately prepared for discussions I will set up a more formal discussion forum on blackboard where students will have to post a question to the class and respond to questions from other students' posts before the discussion period. I will actively participate in discussions and should be used as a reference to answer some of the more difficult questions on the topic. Your ***discussion facilitation/class participation*** grade will be based on how well you facilitate a lively and stimulating discussion, how frequently you contribute to discussions, and the quality of the questions/comments that you pose.

- **Assignments:** You will have four types of assignments for this course:

  1. ***Reflections:*** For each discussion topic you lead you must submit a short reflection (~ 1 page, single-spaced). Reflections are meant to help you synthesize and retain the information/ideas covered during discussions and prepare you to write your essay. After you have received critical feedback from the instructor and the other students (see below) you must submit a final version of your reflection for other students to use as a resource.

2. ***Essay:*** You will write an essay after we complete the "***Ecological Science***" portion of the class. The topic will focus on assessing the current state of scientific knowledge/understanding for implementing ecosystem management.

3. ***Critiques:*** Each student must critique each reflection submitted by other students and critique one other student's essay.

4. ***Case Study:*** You will work as a group on a semester-long project

- **Reading material:** Many of the readings will come from the primary scientific literature. I will provide PDF files of these readings. You also must purchase the following two books:

  Ecosystem Management: Adaptive Community-Based Conservation *by: G.K. Meffe, L.A. Nielsen, R.L. Night, & D.A. Schenborn. 2002*
  - e-book from the UNC library: http://search.lib.unc.edu/search?R=UNCb5902573

  Ecosystem-Based Management for the oceans *Edited by: K. McLeod & H. Leslie. 2009*

GRADING

Your final grade will be based on the following 5 components:

Course Component	% of Final Grade
• Discussion facilitation & class participation	20%
• Reflections	15%
• Midterm essay	20%
• Critiques	20%
• Final project	25%

Final grades will be based on a plus/minus grading scale as follows: A > 92; A- = 90-92; B+ = 87-89; B = 83-86; B- = 80-82; C+ = 77-79; C = 73-76; C- = 70-72; D+ = 67-69; D = 63-66; D- = 60-62; and F < 60.

ENST 490 Special Topics: Humans and Their Microbiological Footprint

Course taught by Dr. Rachel T. Noble, Associate Professor, Institute of Marine Sciences
Study Abroad summer session
3 week course
45 Contact hours

Aims

This course will familiarize the student with basic processes in coastal systems, with a focus on human impacts including waste disposal, onsite wastewater systems, wastewater treatment processes, and transport of microbial contaminants. The student will gain an appreciation for state-of-the-art methods for quantification of pathogens and monitoring of indicators. The student will gain an understanding of the impacts of anthropogenic processes that impact complex estuarine ecosystems, especially in heavily developed coastal and island environments.

Strategy of the class: Subject matter will be presented in the form of a series of formal lectures and classroom demonstration, and in laboratory interaction. The focus will be on coastal systems, but we will also attempt to compare and contrast local coastal systems to others around the globe. There will be a midterm exam and a final exam on some of the basic concepts that are presented in the lectures and on research excursions and in laboratory demonstration and discussion. Issue papers will be due in the middle of the semester time and will require the student to give a 10 minute power point presentation and prepare a short paper on any of a number of coastal resource issues. Field work and laboratory sessions involving experimental investigations have been designed to reinforce lecture theory and to provide hands-on experience with techniques discussed in lectures and in seminars. Research excursions will require students to work as a team and to develop the technical skills for basic scientific research.

Course evaluation:

Midterm Exam: 20%, Final Exam: 35%, Field Excursions and Data Analysis: 10%, Issue Paper: 15%, Paper Critique, 5 %, Participation/Teamwork: 15%

Tardiness is built into the participation portion of the grade, multiple examples of tardiness (3), whether for field trips or lectures, will result in complete loss of participation/teamwork points toward grade. Grading will follow straightforward guidelines: A=90-100, B=80-89, C=70-79, D=60-69, the grading will not based upon a curve.

We will adopt the honor code in place on campus at Chapel Hill: "It shall be the responsibility of every student at The University of North Carolina at Chapel Hill to obey and support the enforcement of the Honor Code, which prohibits lying, cheating, or stealing when these actions involve academic processes or University, student or academic personnel acting in an official capacity." Adapted from a "How to Have Honor Prevail in Your Classroom", a handout prepared by Margaret Barrett, Judicial Programs Officer, UNC Chapel Hill.

Course schedule

Topic / Activity	Contact hours
1. Review of coastal, lagoonal and estuarine dynamics	3
2. Review of human impacts and public health risk	3
3. How do we measure water quality?	3
4. Introduction to viral and bacterial pathogens	3
5. Discussion of protozoan pathogens	2
6. Introduction to disease and virulence	2

7. What is microbial risk assessment	5
8. Microbial quantification in source and drinking water	3
Labs: Chromogenic substrate methods demonstration and use	3
Midterm Test	2
9. Treatment of waste, transport to receiving waters, reduction of pathogens	2
10. Pathogens and indicators in recreational waters	3
11. Ambient water quality criteria, how does it apply to developing areas?	3
Labs: Statistically relevant water quality monitoring, and sanitary survey approaches (in the field)	5
12. Managing water and improving sanitation in developing countries	2
13. Climate change impacts on surface and drinking water	2
14. Future expectations for climate change impacts on water	2
Final Exam	2

ENST 490 Special Topics: Oceanography of the Eastern Tropical Pacific Ocean and Galapagos Islands

Summer program, Galapagos Islands
Professor: Thomas Shay (UNC)

Course Description

The course will begin with a brief introduction to the relevant atmospheric science and oceanography, followed by more focus on topics unique to the eastern tropical Pacific Ocean and the Galapagos Islands. The emphasis is on physical oceanography and biogeochemistry. Activities will consist of lectures, student-led discussions of readings, perusal and analysis of data, and field trips to make direct observations and introduce measurement techniques. On a typical day, we will engage in several of these activities. As much as possible, the course will consist of active participation by the students, so that they stay engaged with the material. After completing this course, students will have some understanding of general physical oceanography, the history of science in the Galapagos Islands, ability to interpret atmospheric and oceanic data, and an introduction to field work,

Course Materials

There will be no required textbook, but there will be required reading of review articles and research papers from the scientific literature. All of the reading material will be made available as PDFs, and we assume that all students have access to laptop computers. Each student will be required to keep a bound notebook in which they take course notes, notes on their reading, and filed notes. The instructor will periodically review the notebooks, and they will be evaluated as part of the students' final grades.

Instructors

The course will be taught at the joint UNC and USFQ Galapagos Research Center on San Cristobal Island, Galapagos, Ecuador. It will be co-organized and co-taught by Thomas Shay, PhD (UNC), with the involvement of instructors from Unversidad San Franicisco de Quito.

Evaluation

Students will be evaluated based on several brief quizzes, a final exam, the required notebook, field reports, and participation in class discussions. Each student will be responsible for leading one class discussion of assigned reading, but all students are expected to participate in all discussions.

Quizzes	25%
Notebook	15%
Field reports	10%
Assigned Discussion Lead	10%
General Participation	10%
Final Exam	30%

Course Contents and Schedule

Topics	Contact hours
Atmospheric processes	3
Eastern tropical Pacific atmospheric setting	3
Oceanographic processes	5
Eastern tropical Pacific oceanographic setting	5
El Nino/Southern Oscillation (ENSO) and other quasi-periodic phenomena	3
Coastal and nearshore oceanography (including field work)	9
Mangroves and wetlands (including field work)	6
Eutrophication of coastal environments	3
Climate Change, global warming, sea-level rise	5
Hydrothermal vents	3

GEOG 491: Geographic Information Systems

Stephen J. Walsh & Philip H. Page
Department of Geography, UNC-Chapel Hill

GAIAS, San Cristobal Island, Galapagos

Introduction

Organizations that have a planning, research, management, operational and/or regulatory responsibility at the local, county, state, or federal level are increasingly turning towards Geographic Information System (GIS) technology as an approach to data integration, synthesis, and modeling. Lack of spatially trained and sophisticated GIS specialists fluent in the spatial language and concepts of GIS are adversely impacting upon the level and effectiveness of GIS use by organizations, researchers, and decision-makers. Too many users are permitting their GIS software to drive their spatial analyses without sufficiently appreciating and incorporating spatial considerations that represent a blending of spatial, natural, engineering, and computer sciences combined to mold and shape the analyses and interpret the results.

Geographic information systems (GIS) and the associated spatial digital technologies of remote sensing, data visualization, global positioning systems, spatial analysis, and quantitative modeling are among those important spatial technologies that have gain prominence in geography and are emerging into associated social and biophysical sciences. They offer the opportunity to gain fresh insights into social and biophysical systems through, for example, the spatial, temporal, spectral, and radiometric resolutions of remote sensing systems and through the analytical and data integration capability of GIS. GIS and remote sensing technologies can be linked together into a synergistic system that is particularly well suited to the examination of landscape conditions through the interrelationships of scale, pattern, and process; a paradigm that has gained prominence in the fields of biogeography and landscape ecology and currently being applied in studies involving population-environment interactions. In this course, GIS technology is the methodological focus, but other associated technologies will be integrated where appropriate through analysis and discussion to characterize landscape features.

Geographic Information System technology offers an analytical framework for data synthesis that combines a system capable of data capture, storage, management, retrieval, analysis, and display. From a functionality perspective, GIS techniques can examine spatial and non-spatial relationships through analytical tools and techniques that include *attribute operations*, *overlay operations*, *neighborhood operations*, and *connectivity operations*; can represent an array of landscape perspectives through the integration of geographically registered spatial coverages; can efficiently display such information through a variety of data visualization approaches for spatial and temporal pattern analysis; can examine the co-occurrence of spatial and non-spatial data through database manipulations; can display singular thematic coverages or composited coverages through cartographic and/or statistical approaches; and can model the location and behavior of phenomena through interfaces to multivariate models, causal models, and pattern indices.

GIS and the other spatial technologies operate synergistically to create a model of reality that reflects the informational requirements of the project and the data visualization needs of the user. To achieve this duality of information and presentation, paradigms of map-making have shifted from the communication paradigm to the analytical paradigm. This shift is marked by a departure from the physical map as the final cartographic product, in which base information has been transformed and

symbology applied for graphical display, to an approach in which raw geographic data are stored in a computerized database to provide multiple views of the information to multiple users and where the physical map is but only one form of visualizing spatial pattern, distribution, and association. The power of the GIS is based on its interactivity, integration, map customization, & alternative visualizations offered to the analyst.

Objectives

Students will become familiar with the spatial theory, analytical functions, and software capabilities associated with the use of GIS related to spatial and thematic maintenance functions, classification and measurement functions, neighborhood functions, overlay functions, connectivity functions, and modeling functions that can be applied to single maps, map pairs, or multiple maps.

Maintenance functions are used to edit and query thematic or attribute data, and to register, transform, rectify, and edit spatial elements of features. *Classification and measurement functions* involve the retrieval of spatial and thematic data for the modification or creation of attribute information and the calculation of distance and associated spatial measurements respectively. *Overlay functions* involve arithmetic and logical operations that relate map layers through mathematical and Boolean operators. *Neighborhood functions* characterize the area surrounding a specified location. *Connectivity functions* accumulate values over directional traverses using contiguity measures, proximity measures, and network measures. *Modeling functions* involve cartographic approaches of combining maps together in a logical sequence through a series of spatial operations that address the questions of how objects are organized in space and what is the profile of their attributes, and statistical techniques that explore the relationship between variables through quantitative operations.

Course Requirements

This course will cover the same topic material as the normal, on-campus UNC offering and include the same requirements, but the course project and data collection will be tailored for the setting in the Galapagos archipelago.

(1) Lecture will examine GIS tools, analytical approaches, and applications. Readings associated with each topic will comprise the assigned literature for the course. Primary discussions will be around the reading material and lecture topics.

(2) Labs will be assigned in conjunction with selected lecture topics and hands-on processing will be completed in the GAIAS Computer Lab. UNC-Chapel Hill has an institutional site license for a selected group of ESRI (Environmental Systems Research Institute) products, including ARCGIS. Therefore, labs will be completed using your personal laptop computer and a software key from UNC as well as by using software placed on a local GAIAS server for the course. Three labs will be assigned as part of this course: (a) data sources, representation, and models, (b) land use/land cover change in the Ecuadorian Amazon, (c) population-environment interactions in the Galapagos Islands.

(3) Course Project & Paper will be completed as a team enterprise that involves no more than 4-students per team. The assignment involves (a) the generation of a set of research aims, (b) design and encoding of a GIS data base to support the project aims for a study area of your choice, (c) design and implementation of a set of spatial analyses with a bias towards GIS, (d) discussion and interpretation of findings, and (e) documentation of approach, data, methods, analysis, discussion & interpretation, and conclusions by using maps, graphics, statistics, and

writing a report. Please be cognizant of data volumes limitations and the need to keep the study area relatively small (geographically) and the data themes in the GIS limited to those base layers that are considered most critical and appropriate to the analysis. The paper should be approximately 10 double-space, type written pages. Final grades will be determined through the following course requirements:

Labs	25% of score
Team Presentation & Paper	25% of score
Midterm Examination (Exam #1)	25% of score
Final Examination (Exam #2)	25% of score

Text: Bolstad, P. 2008. *GIS Fundamentals*, Eider Press, Third Edition.

Class Schedule

WEEK 1

Class 1 – Welcome and basic information; introduction to GIS: systems, science, and study (3 hours)

Class 2 – Data models, attributes and vector & raster data structures (Lab #1: ARCGIS) (3 hours)

Class 3 – Datum, map projections & coordinates; shape files, spatial & non-spatial information (3 hours)

Class 4 – Data sources and data creation; the global positioning system (3 hours)

Class 5 – Aerial photography & satellite images (3 hours)

WEEK 2

Class 6 – Digital remote sensing & image processing considerations (3 hours)

Class 7 – Attribute data and tables: presentation of project proposals (3 hours)

Class 8 – Exam #1 and spatial analysis & GIS (3 hours)

Class 9 – Topics in raster & vector data analysis (Lab #2: ARCGIS) (3 hours)

Class 10 – Spatial estimation; spatial models & modeling (3 hours)

WEEK 3

Class 11 – Spatial simulation models: cellular automata & agent-based models (3 hours)

Class 12 – Data quality, standards & documentation (3 hours)

Class 13 – Field Data Collection: Validation & Calibration (Lab #3: ARCGIS) (3 hours)

Class 14 – Team Presentations of Special Projects (3 hours)

Class 15 – Exam #2 & concluding comments (3 hours)

ENST 490 Special Topics: Sustainable Tourism
Syllabus

Instructor
David Salvesen, PhD
Center for Sustainable Community Design
Institute for the Environment
University of North Carolina at Chapel Hill

Contact
Email: salvesen@unc.edu Office: (919) 962-7045

Purpose of the Class
To examine the social, economic and environmental impacts of tourism and explore how tourism can be made more sustainable.

Aims
At the completion of the course, students should be able to:
- Understand the concept of sustainable development and sustainable tourism,
- Critically analyze the impacts of tourism on the economic, social and physical environment,
- Develop criteria for sustainable tourism,
- Apply sustainable development concepts to tourism planning, and
- Critically evaluate arguments for and against sustainable tourism.

Week I: Introduction and Overview (15 hours)
I. Evolution of tourism and emerging trends (3 hours)

II. Issues and Impacts of (traditional) tourism (3 hours)
People
Place
Environment

III. Principles of sustainable development (3 hours)
Economy
Environment
Equity

IV. Principles of sustainable tourism (3 hours)
Criteria
Characteristics
Examples and case studies

V. The future of tourism (3 hours)
Exam I

Week II: Sustainable Tourism in Practice: Issues and Examples (15 hours)
I. Conserving biodiversity; improving land use planning and management (3 hours)

II. Energy efficiency, conservation and renewable energy (3 hours)

III. Managing solid wastes, water use and wastewater (3 hours)

IV. Preserving local cultures and communities; providing local economic benefit (3 hours)

V. Exam II (3 hours)

Week III: Case studies, field trips, student presentations (15 hours)
I. Case studies of sustainable tourism (3 hours)

II. Field trip to local tourism project (3 hours)

III. Field trip to local tourism project (3 hours)

IV. Student presentations (3 hours)

V. Course wrap-up (3 hours)

Course Requirements
Two exams
Final Project – proposed sustainable tourism project
Class participation

Grading

Exam I	25%
Exam II	25%
Student project	40%
Class participation	10%

Required Texts
Ecotourism and Sustainable Development, Second Edition: Who Owns Paradise? 2008. Martha Honey. Island Press

Tourism: Principles, Practices, Philosophies. 2009. Charles Goeldner and J.R. Brent Ritchie
John Wiley & Sons

Reserve Readings
Bramwell, Bill and Bernard Lane. 2010. Sustainable tourism and the evolving roles of government planning. *Journal of Sustainable Tourism*. Vol 18:1, pp.1-5

Marsh, George Perkins. 1864. *Man and Nature*, Chapter II: Transfer, modification and extirpation of vegetable and animal species, pp 53-113

Pickering, Catherine and Ann Mount. 2010. Do tourists disperse weed seed? A global review of unintentional human-mediated terrestrial seed dispersal on clothing, vehicles and horses *Journal of Sustainable Tourism*. Vol 18., No. 2. pages 239 - 256

Schellhorn, Matthias. 2010. Development for whom? Social justice and the business of ecotourism. *Journal of Sustainable Tourism*. Vol 18:1, pp.115-135

Appendix 4

Non-UNC Faculty CVs

Curriculum vitae

Dr. Judith Denkinger
Universidad San Francisco de Quito
PO Box 17-12-841
Quito, Ecuador
Telephone: 2894-806
email: judithd@usfq.edu.ec

Personal data:

Name:	Denkinger, Judith, Dr. rer. Nat.
Date of birth:	19th of December 1968
Place of birth:	Ulm, Germany
Nationality:	German
Residence:	Ecuador
Children:	Emilia Campos Denkinger (born the 4th of December 1999), Laura Campos Denkinger (born the 30th of April 2001).

Work experience: -

8/ 2006 -	Professor at the Colegio de Sciencias Biológicas y Ambientales (College for biology and environmental Sciences) at San Francisco University, Quito
2/2006 – 6/2006	Research coordination of the Marine Investigation in the Project: "Action Plan for the conservation proposal of a coastal-marine protected area in the South of the Province of Esmeraldas (ESMEMAR)" Fundación Agua/NAZCA.
11/2005 – 6/ 2006	Water and soil monitoring of oil fields in the Ecuadorian Amazon for Grüntec environmental Laboratory.
6/ 2004 – 10/2005	Research coordinator of the project „integrated reef conservation program, Esmeraldas – Ecuador" SIMBIOE/ NAZCA.
10/ 2003 – 6/ 2004	Scientific consultant in the project „ eco-regional planning of the equatorial Pacific region" - „The Nature Conservancy".
4/ 8 and 10 2004	Coordination and fieldwork of the NAZCA "Seasurface fauna monitoring program on the Ecuadorian research vessel Orion".
7/ 1999 – 7/ 2004	Project coordinator of project, „Conservation of the Atacames reef area through whale watching" financed by PPD/ UNDP/GEF and Yaqu Pacha (Society for the conservation of South American aquatic mammals).
7/ 2003 – 10/ 2003	Implementation of the Marine Conservation Center, Súa with an exposition about the native marine fauna in cooperation with a local fishermen association "Asociación Aventuras de Mar Elaboration of a data base on the ecuadorian fauna and flora
2/ 2002 – 6/ 2004	Reefmonitoring and biodiversity studies on the Atacames reef area.
2000 -	Coordination of the Yaqu Pacha/ NAZCA humpback whale conservation program in Esmeraldas and Manabi.
5/ 1996 – 12/ 2001	Coordinator of the organization Yaqu Pacha in Ecuador.

5/ 1996 – 2000	Project coordinator of the Yaqu Pacha humpback whale conservation program in Manabi, Ecuador.
8 – 9 1995	Scientific assistant on the Whale and seabird monitoring program on the Shetland Islands, Scotland for the Sea Watch Foundation.
7 – 8 1995:	Scientific observer for Minke whale monitoring on the NILS 1995 survey (Norwegian Independent Line Transect Survey) in the northern Norwegian sea for the Norwegian fisheries institute Bergen.
7 - 8 1994:	Scientific observer for small cetaceans on the SCANS Survey (Small Cetacean Abundance in the North Sea) financed by the European community.
9 – 10/ 1993:	Scientific assistant on the investigation of herring shoals in the North Sea on the Research Vessel Alkor of the University of Kiel, Germany.

Academic career

1996 – 2001:	PhD or doctoral studies at the University of Ulm (1996 – 1998) and University of Bielefeld (1998 – 2001), Germany on „demographic studies on the Amazon river dolphin (*Inia geoffrensis*) in the Cuyabeno Reserve, Ecuador", financed by a grant of the German academic exchange program and Yaqu Pacha.
13th of November 2001	Doctoral (PhD) degree with „cum laude".
1990 – 1995	Biology Diploma studies at the Albert Einstein University Ulm, Germany.
20th of June 1995	Diploma (Master) exam with the note „excellent" (sehr gut).
1989 – 1990	Biology/ Chemistry studies for high school teachers at the Justus Liebig University Giessen, Germany.
1989	French language studies at the „École de Francais Moderne, Université de Lausanne", Switzerland.
1979 – 1988	High school Stuttgart Neugereut. Final exam the 16th of May 1988 with the note 2,5.

Relevant activities and experiences

8/ 2004	Formation of the NAZCA Institute for marine sciences in Ecuador.
2000 – 2004	Workshops and seminars for native fishermen on subjects related to marine conservation issues with focus on marine mammals.
1996 – 2000	Seminars and workshops for native Indians such as Siona, Quichua, Secoya and Cofan, Park rangers and Militaries with subjects related to Rainforest and aquatic mammal conservation.
8 -9 1992	Marine Biology course on plankton societies at the Institute for Marine Sciences (IFM) Kiel University, Germany.
1992 – 1994	Teaching assistant on University courses for animal physiology for biologists and biology for medical students at Ulm University, Germany.
8/ 1990	Course in benthos communities and subaquatic field methods in Brunsnäs, Danmark.

1990 – 1995	White water kayaking teacher at Ulm University.
6 -7/ 1984	CERCAM Dive course with the French army in Porquerolles, France.
11/ 2004	PADI „open water" and „advanced" diving license.

Computer work

Arc view
Photoshop
Excel
Access
Word

Language skills:

English (fluent), Spanish (fluent), French (fluent),

German (mother tongue)

Publications

- Terán, M.C., Clark, K., Suárez, C., Campos, F., Denkinger, J., Ruiz, D. y P. Jimenez. 2006. Análisis de Vacíos e Identificación de áreas Prioritarias para la Conservación de la Biodiversidad Marino-Costera en Ecuador Continental. Resumen Ejecutivo. Ministerio de Ambiente, Quito, Ecuador
- Denkinger, J., M.J. Barragán, P. Brtnik, V. Cano, C. Pairoa Riofrio, M. Rodríguez and C. Yumiseva. 2004. Informe Nacional sobre el estado actual de los mamíferos marinos del Ecuador. CPPS – Programa de Acción para la Conservación de Mamíferos Marinos.
- Denkinger, J. Patricia Brtnik, Patricia Flores, Gregorio Mera, Mario Ojeda de la Cruz, Constanza Pairoa Riofrío, Jacinto Satizabal, y Santiago Torres. 2004. Conservación de los Arrecifes en los Bajos de Atacames a través de la observación de ballenas. Informe final Proyecto PPD (PNUD/ GEF). Enero 2002 – Mayo 2004. Asociación Aventuras de Mar, Yaqu Pacha, Simbioe/ Nazca.
- Denkinger, J. 2001. Demographic studies of the Amazon River dolphin (*Inia geoffrensis*) in the Cuyabeno Reserve, Ecuador. PhD Thesis, University of Bielefeld, Germany.
- Scheidat, M., C. Castro, J. Denkinger, J. Gonzalez and D. Adelung. 2000. A breeding area for humpback whales (*Megaptera novaeangliae*) off Ecuador. J. Cetacean Res. and Manage. 2(3): 165-171.2000.
- Denkinger, J., M. Scheidat and C. Castro. 1998. Estimating the population density and abundance of Amazon River dolphins (*Inia geoffrensis*) in the Cuyabeno Reserve, Ecuador. Proceedings of the 1st World Marine Mammal Science Conference, Monaco.
- Denkinger, J., F. Campos, J. Carlström, C. Castro and M. Scheidat. 1999. Influence of boat traffic on the behaviour of the Amazon River dolphin (*Inia geoffrensis*) in the Cuyabeno Reserve, Ecuador. Abstracts of the 13th annual conference of the European Cetacean Society in Valencia, Spain April 1999.

- Denkinger, J., I. Araya and V. Utreras. 1997. Demographic studies of the Amazon River dolphin (*Inia geoffrensis*) in the Cuyabeno Reserve, Ecuador. Proceedings of the 11th annual conference of the European Cetacean Society, March 1997, Stralsund, Germany
- Denkinger J., C. Pairoa Riofrio and M. Scheidat. 1997. A breeding ground for humpback whales (*Megaptera novaeangliae*) in the Machalilla Nationalpark, Ecuador. Proceedings of the 10th international conference of the European Cetacean Society (ECS) March 1997, Stralsund, Germany.
- Denkinger, J. and E. Ortiz C. 1997. Monitoréo de agua en la Reserva de Producción Faunística Cuyabeno. Informe de las investigaciones de agua del proyecto "sacha pacha" de la organización „Yaqu Pacha (Organización para la Conservación de Mamíferos Acuáticos en Sudamérica)". PROFORS (GTZ) y INEFAN.
- .Carlström, J., J. Denkinger, P. Feddersen and Niels Oien. 1997. Record of a new range of Sowerby's beaked whale (*Mesoplodon bidens*). Polar Biology (1997): 17: 459-461
- Von Fersen, L., V. Utreras, I. Araya, J. Denkinger and M. Rodríguez. 1997. The Giant Otter in Ecuador. IUCN Otter Specialist Group Bulletin. Vol. 14(1), April 1997. pp. 20.
- Denkinger, J. and L. von Fersen. 1994. Play behaviour of bottlenose dolphins (*Tursiops truncatus*) in the dolphinarium of Nuremberg. Proceedings of the 9th annual conference of the European Cetacean Society, Lugano, Switzerland 9th to 11th of February 1994.
- Denkinger, J. and L. von Fersen. 1994. Play behaviour of bottlenose dolphins (*Tursiops truncatus*) in the dolphinarium of Nuremberg. Proceedings of the Marine Mammal Society Conference (MMS) Orlando, USA 14th to 18th of December 1995.

CARLOS F. MENA

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Professor, College of Life and Environmental Sciences
Co-Director, Graduate Program in Tropical Ecology
Co-Director, Centro Isabela para Estudios en las Islas Galápagos
Co-Director, USFQ GeoCenter
Universidad San Francisco de Quito, Ecuador

Adjunct Professor, Department of Geography
University of North Carolina at Chapel Hill, USA

Recent Consulting: Ministry of Environment of Ecuador, Ministry of Culture of Ecuador, Galapagos National Park, Ministry of Foreign Affairs of Ecuador

Member, Steering Committee 2008-2010
International Geographic Union, Land Use and Land Cover Commission

Member, Editorial Board
Population and Environment

EDUCATION:

University of North Carolina at Chapel Hill
Ph.D., Geography, 2007
Graduate Certificate in International Development
Dissertation: Land use trajectories in the Ecuadorian Amazon: socioeconomic drivers, spatial explicit modeling, and future scenarios.
Advisor: Dr. Stephen J. Walsh

Florida International University, Miami, FL
Master in Science, Environmental Studies Department, 2001
Thesis: Deforestation and land use patterns in the Napo Basin
Advisor: Dr. Michael McClain

Escuela Politécnica del Ejército, Quito, Ecuador
Ingeniero Geógrafo y del Medio Ambiente, 1999
Tesis: Sensibilidad Ambiental del Parque Nacional Llanganates

PROFESSIONAL EXPERIENCE:

Universidad San Francisco de Quito, Ecuador
Professor, College of Life and Environmental Sciences Co-Director, Graduate Program in Tropical Ecology
Co-Director, Centro Isabela para Estudio de las Islas Galápagos
January 2008-Present

University of North Carolina at Chapel Hill
Department of Geography
Post-Doctoral Researcher, Fall 2007

University of North Carolina at Chapel Hill
Department of Geography
Teaching Fellow, Fall 2006

University of North Carolina at Chapel Hill
Department of Geography/ Carolina Population Center
Research Assistant. 8/2002 to 8/2007

Florida International University.
Andean Amazon Rivers Analysis and Management Project (AARAM).
Research Assistant. 01/2000 to 08/2002

EcoCiencia, Fundación de Estudios Ecológicos. Quito, Ecuador.
Geographer. 07/1998 to 12/1999

Fundación Natura. Quito, Ecuador.
Technical Assistant. 10/1997 to 06/1998

ACADEMIC HONORS:

- American Society for Photogrammetry and Remote Sensing, ESRI Award for Best Paper in Geographic Information Systems (2nd Place).
- Earth Systems Science Fellowship. *National Aeronautics Space Administration* (NASA), 2004-2007, $72,000
- Pre-Doctoral Traineeship. *NIH Fogarty International Center - Carolina Population Center*, 2002-2004, $74,000
- Anne U. White Fund Grant. *Association of American Geographers*, 2006, $1,000
- Residency Grant. Mellon Foundation - *Carolina Population Center*, 2005, $12,000
- Future Faculty Fellowship. *UNC Center for Teaching and Learning*, 2006, $500
- Pre-dissertation Fieldwork Award. *UNC Institute Latin American Studies* - The Tinker Foundation, 2004, $1,500
- NSF-IGERT Travel Grants. IGERT Program. *Carolina Population Center* - National Science Foundation, 2004-2007, $4,500

- Latin America and Caribbean Scholarship, *Florida International University*, 2000-2001; $18,000
- Programa de la Conservación de la Biodiversidad, *EcoCiencia*, Fundación de Estudios Ecológicos, Quito, Ecuador, 1998, $1,200

PEER REVIEWED PUBLICATIONS

Walsh SJ, Malanson GP, Brown DG, Messina JP, **Mena CF** (In Press). Biocomplexity. In: *Handbook of Biogeography*, M. Blumler M, G. MacDonald, A. Millington, U. Schickhoff (Editors), Sage Publications, London.

Walsh, SJ, **Mena CF,** DeHart J, Frizzelle FG (2009). Stylized environments and ABMs: educational tools for examining the causes and consequences of land use/land cover change. *Geocarto International*, 24: 1752-0762

Mena, CF (2008). Trajectories of Land Use and Land Cover in the Northern Ecuadorian Amazon: Temporal Composition, Spatial Configuration, and Probability of Change. *Photogrammetric Engineering and Remote Sensing* 74(6): 737-752

Walsh, SJ, Shao Y, **Mena CF**, McCleary A (2008). Integration of Hyperion Satellite Data and a Household Social Survey to Characterize the Causes and Consequences of Reforestation Patterns in the Northern Ecuadorian Amazon. *Photogrammetric Engineering and Remote Sensing* 74(6): 725-736

Walsh SJ, McCleary A, **Mena CF**, Tuttle J, Shao Y, Atkinson R, Gonzales A, (2008). Hyper-Spatial and Hyper-Spectral Remote Sensing of an Invasive Plant in the Galapagos National Park and Archipelago: Spatial Structure and Implications for Control. *Remote Sensing of the Environment* 112(5):1927-1941

Walsh SJ, Messina JP, **Mena CF**, Malanson GP, Page PH (2008). Complexity and Land Use Dynamics in the Northern Ecuadorian Amazon, *GeoForum* 39:867-878.

Rindfuss RR, Entwisle B, Walsh SJ, An L, Badenoch N, Brown DG, Deadman P, Evans TP, Fox J, Geoghegan J, Gutmann M, Kelly M, Linderman M, Liu J, Malanson G P, **Mena CF**, et al. (2008) "Land use change: complexity and comparisons" *Journal of Land Use Science* 3(1): 1 – 10

Rindfuss RR, Entwisle B, Walsh SJ, **Mena CF**, Erlien CM, Gray CL (2007). Frontier Land Use Change: Synthesis and Next Steps, *Annals of the Association of American Geographers* 97(4): 739-754

Mena CF, Bilsborrow RE, McClain ME (2006). Socioeconomic Drivers of Deforestation in the Northern Ecuadorian Amazon. *Environmental Management* 37(6): 802-815.

Mena CF, Barbieri A, Walsh SJ, Erlien CM, Bilsborrow RE, Lu F (2006). Pressure on the Cuyabeno Wildlife Reserve: Development and Land Use/Cover Change in the Northern Ecuadorian Amazon. *World Development* 34(10): 1831-1849.

Messina J, Walsh SJ, **Mena CF**, Delamater P (2006). Land Tenure and Deforestation Patterns in the Ecuadorian Amazon: Conflicts in Land Conservation in Frontier Settings. *Applied Geography* 26(2): 113-128.

Erlien CM, Tuttle JP, McCleary AL, **Mena CF**, Walsh SJ (2006). Complexity Theory and Spatial Models of Land Use/Land Cover Dynamics: Implications of "What if" Scenarios for Education, Land Management, and Decision-Making, *Geocarto* 21(4):67-74.

Frizzelle BG, Walsh SJ, Erlien CM, **Mena CF** (2004). Establishing Remote Sensing Control in a Frontier Environment: the Case of the Ecuadorian Amazon. *Earth Observation Magazine* 12 (7):20-24

Frizzelle BG, Walsh SJ, **Mena CF**, Erlien CM (2005). Land Use Change Patterns of Colonist and Indigenous groups in the Northern Ecuadorian Amazon: A Comparison of Landsat TM spectral and Spatial Analyses. Proceedings, American Society for *Photogrammetry and Remote Sensing*, Baltimore, Maryland (Electronic)

Mena CF (2001) Mapa de Uso de Suelo y Cobertura Vegetal del Parque Nacional Llanganates en *Biodiversidad del Parque Nacional Llanganates*, Vazquez M. (Editor). EcoCiencia. Quito

Mena CF, Walsh SJ, Bilsborrow RE (In Preparation). Socioeconomic and Demographic Drivers of Secondary Forest Regeneration in the Northern Ecuadorian Amazon, *Regional Environmental Change.*

Mena CF (In preparation). Spatial Heterogeneity and Non-Stationarity of the Drivers of Deforestation and Agriculture Extensification.

Mena CF (In preparation). Linking Spatial Heterogeneity, Household Surveys, and Cellular Automata Models to Create Land Use Land Cover Scenarios.

RESEARCH GRANTS AND PROJECTS

- Assessment of the Vulnerability of Biodiversity and Related Well Being in the Galapagos Islands to Climate Change Project (Co-PI)
- Socioeconomic Effects of Climate Change in the Galapagos Islands: An Emphasis on the Marine Resources and Marine Reserve (Co-PI)
- Drivers of land use and land cover change in the Ecuadorian Amazon

- People and protected areas: the case of the Cuyabeno Reserve
- Secondary forest succession in the Ecuadorian Amazon
- Remote Sensing of tropical environments: Isabela Island
- Agent based model and cellular automata in the Northern Ecuadorian Amazon
- Geography (the discipline) in Ecuador

REVIEWER

- United States National Science Foundation (NSF) - Geography and Regional Science Program
- Geocarto International, Journal
- Journal of Environmental Management
- Journal of Earth Systems Science

ORGANIZER

Session Organizer (with C. Gray), *Conservation and Development from the Andes to the Amazon* I, II, III, and IV. Set of Sessions Organized for the Annual Meeting of the Association of American Geographers. San Francisco, California, April 21, 2007.

Workshop Organizer (with S.J. Walsh), *Geographic Information Systems and Remote Sensing for the Conservation and Sustainable Management of the Galapagos Islands*. Santa Cruz, Galapagos, June 21-22, 2006

Session Organizer (with C. Gray), *Human-Environment Studies from the Andes to the Amazon*. Session Organized for the Annual Meeting of the Association of American Geographers. Denver, Colorado, April 5-9, 2005.

Symposium Organizer (with S.J. Walsh), *Methods for the Characterization of Landscape Change*. Hotel Quito, Quito, June 6, 2005.

Workshop Organizer (with R.E. Bilsborrow and B. Torres), *Agricultural Colonization in the Ecuadorian Amazon: Meetings for Farmers and Local Authorities*. Lago Agrio and Coca, Ecuador, July 2004.

SELECTED PRESENTATIONS

Mena CF, Walsh SJ, Malanson G, Frizzelle BG. 2008. "Agent Based Modeling for the simulation of endogenous and exogenous shocks in the Northern Ecuadorian Amazon", Poster presented at the Meeting Tough Choices - Land Use under a Changing Climate, US Nacional Science Foundation and German Researhc Foudation, invited participant. Berlin, Germany.

Mena CF. "Exploring the heterogeneous nature of the drivers of deforestation and land extensification in the Northern Ecuadorian Amazon" Paper presented at the Annual Meeting of the Association of American Geographers. San Francisco, California, April 21, 2007.

Mena CF, Walsh SJ, Bilsborrow RE, Erlien CF. "Demography and Land Use/Cover Change in the Cuyabeno and Lago Agrio in Ecuador: Implications for Development". Poster presented at the NASA Land-Cover and Land-Use Change Science Team Meeting, Maryland. April 11-13, 2006

Mena CF, Walsh SJ. "Demographic, Socioeconomic, and Biophysical Factors Affecting Land Use and Land Cover Change in the Northern Ecuadorian Amazon: Drivers, Statistical and Spatial Explicit Models". Paper presented at the XXV Conference of the International Union for the Scientific Study of Population, Tours, France. July 18-23, 2005.

Mena CF, Walsh SJ, Erlien CM. "Development and Land Use/Cover Change in the Cuyabeno Wildlife Reserve" Paper presented at the 101st Annual Meeting of the Association of American Geographers. Denver, CO. April 5-9, 2005.

Mena CF "Deforestation and Spatially Explicit Models for Land Change Research". Department of Geography, Appalachian State University. Boone, NC. April 19, 2006.

Mena CF, Walsh SJ. "Socioeconomic and Demographic drivers of Forest Succession in Northern Ecuadorian Amazon". Paper presented at the 100th Annual Meeting of the Association of American Geographers (AAG), Philadelphia, PA. March 14-19, 2004.

Barbieri AF, **Mena CF**, Erlien CM, Bilsborrow RE, and Torres B. 2003. Settler Welfare and Land Cover Change in the Ecuadorian Amazon Communities. Poster presented at the Human Dimensions of Global Change Open Meeting. Montreal, Canada. October 16-18, 2003,

Mena CF, Erlien CM, Walsh SJ, Bilsborrow RE, and Baquero F. "Modeling the Scale Dependent Drivers of LCLU Dynamics in Northeastern Ecuador: Population, Biophysical, and Geographical Factors." Paper presented at the 99th Annual Meeting of the Association of American Geographers (AAG), New Orleans, LA. March 4-7, 2003

Mena CF. 2002. "Socioeconomic Drivers of Deforestation in the Northern Ecuadorian Amazon". American Association of Geographers, South East Division (SEDAAG) Meeting, 23-26 November 2002, Richmond, VA

Mena CF. 2001. "Spatial Patterns, metrics, and socioeconomic factors driving deforestation in the Napo Basin of Ecuador". Open Meeting of the Human Dimensions of Global Environmental Change Research Community, October 6-8, 2001, Rio de Janiero, Brazil

Mena CF, Taff G, Frizzelle B, McGregor SJ. 2000. "Integrating Geographic Information Science Techniques and Household Socio-economic Surveys of Population Environment research: A Preliminary

Report." Presented at the Meeting of the Latin American Studies Association, March 16-18, Miami, Florida.

PROFESSIONAL ASSOCIATIONS

American Association of Geographers (AAG)
Population Association of America (PAA)
International Union for the Scientific Study of Population (IUSSP)

Diego Quiroga

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Quito, Ecuador
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Telephone: 593 2 297 1810 or 297 1812 Cell Phone 593 9 9706 982

Education

Ph.D., University of Illinois at Urbana-Champaign, Urbana, IL. Anthropology. 1994
M.A., University of Illinois at Urbana-Champaign, Urbana, IL. Anthropology. 1987
B.A., University of California Berkeley. Anthropology and Psychology. 1982

Area of Specialization:

Areas of Interest: Human Ecology, Political Ecology. Medical Anthropology

Regions: Galapagos, Amazon, Andes.

Academic and Related Appointments

2006-present	Vice-president of Students and External Affairs
2006-Present	Professor International Education for Students
2006-Present	Country Director, Ecuador: International Partnership for Service Learning and Leadership. (IPSL)
2005 2003	Director del Proyecto USAID Gobernabilidad de las Galápagos
2004-Present	Vice President Student and External Affairs Universidad San Francisco de Quito. Dean of the General College.
2003-Present	Director for USFQ of US AID Project Conservation of the Galapagos Marine Reserve
2002-Present	Co-Director, Galapagos Academic Institute for the Arts and Sciences (GAIAS). Quito and Galapagos Islands, Ecuador.
2004-2006	President Environmental Foundation Jatun Sacha
2001-Present	Board Member, Jatun Sacha Foundation, Ecuador.
1999	Dean of the Graduate School, Universidad San Francisco de Quito, Ecuador.
1996	1996 Dean of Academic Affairs, Universidad San Francisco de Quito, Ecuador.
1994-1996	Dean of Humanities and Social Sciences, Universidad San Francisco de Quito, Ecuador.
1991-1996	Full-time Professor, Universidad San Francisco de Quito, Ecuador. Designed and taught courses in History, Andean Anthropology and Medical Anthropology.

Research Grants

1997- 1999	MacArthur Foundation Grant. "System of Production, Population, Health and Consumption in the Upper Amazon."
1991	Graduate College Dissertation Research Grant. University of Illinois at Urbana-Champaign. "The Role of the Saints in Curing in Ecuador."
1990	Grant, Summer Research. Department of Anthropology, University of Illinois at Urbana-Champaign. "Capitalism, Magic and the Devil."
1985	Grant, Tinker Foundation. Research on Nutritional Topics in Colombia. Summer Research, Department of Anthropology, University of Illinois at Urbana-Champaign.

Research and Field Experience

2008-2009	Co- PI Conservation International Seascape Grant Socioeconomic and Governance Assesment of the Galapagos Marine Resever
2008-2009	PI Socioeconomic Effects of Climate Change in the Galapagos Islands: An Emphasis on the Marine Resources and Marine Reserve
2008-2009	Ciencia para la sostenibilidad en Galápagos (Agencia Española de Cooperacion Internacional)
2007-2008.	Hacia una visión compartida de Galápagos: el archipiélago como un sistema socio-ecológico(Agencia Española de Cooperacion Internacional)
2004-2006	Investigación sobre las pesquerías en Galapagos y las Cooperativas Pesqueras.
2007	Socio Environmental Sistems in Galapagos: Resilience and Complexity Universidad Autonoma de Madrid
2005-2006	Research The Fishermen of the Galapagos. A Study of the Fishing Cooperatives. USAID Program Director
1998-2000	Research. "Amazon Basin Productive Systems and Health of Communities living in the Upper Amazon Basin, Ecuador."
1994	Research. "The Acceptance of Health Programs in the Ecuadorian Highlands, Centro Andino de Acción Popular (CAAP)."
1988-1990	Research. Esmeraldas Province, Ecuador. "Magic and Healing: The Role of the Devil and the Saints in Muisne, Ecuador."
1985	Research. Colombian and Ecuadorian Pacific Coast. Gathered and analyzed information regarding economic and medical practices in the Pacific Coast of Colombia and Ecuador.
1983	Research. Imbabura Province, Ecuador. Fundación Eugenio Espejo. "Iodine deficiency and its effects."
1982	Research. Guayas Province, Ecuador. Archaeological Research, Valdivi Culture.

Publications

Quiroga D. 2009 Crafting nature: the Galapagos and the making and unmaking of a "natural laboratory". By Diego Quiroga. Pp 123-140. Journal of Political Ecology: Case Studies in History and Society Volume 16 (2009)

Quiroga D. 2009 Galápagos, Laboratorio Natural de la Evolución: una aproximación histórica In Tapia et. al. Eds. Ciencia para la Sustentabilidad en Galápagos. Parque Nacional Galápagos. Pto. Ayora Santa Cruz.

Quiroga et. al. 2009 Ciencia para Galápagos: una propuesta de estrategia y agenda de investigaciones prioritarias para la sustentabilidad del archipiélago In Tapia et. al. Eds. Ciencia para la Sustentabilidad en Galápagos. Parque Nacional Galápagos. Pto. Ayora Santa Cruz

Quiroga D. y Ospina P. 2009 Percepciones sociales sobre la ciencia y los científicos en Galápagos In Tapia et. al. Eds. Ciencia para la Sustentabilidad en Galápagos. Parque Nacional Galápagos. Pto. Ayora Santa Cruz

Quiroga D. et. al 2008 Hacia una visión compartida de Galápagos: el archipiélago como un sistema socioecológico. Informe Galapagos 2007 2008 Fundacion Cientifica Charles Darwin. Sant Cruz Galapagos

Quiroga, D. 2005 Service Learning in the Context of Ecuador in Knowing and Doing: The Theory and Practice of Service Learning Edi by Linda Chilsholm The International Partnership for Service Learning and Leadership New York.

Quiroga D. 2004 Beyond the Comfort Zone in Humphrey Tomkin Ed. Service Learning Across Cultures: Promises and Achievements a Report for the Ford Foundation. The International Partnership for Service Learning and Leadership New York

Quiroga D. 2003 The Devil and Development in Esmeraldas: Cosmology as a System of Critical Thought. In N. Whitten ed. Millennial Ecuador: Critical Essays on Cultural Transformation and Social Dynamics. University of Iowa Press.

Quiroga, Diego. 2002. "The Devil and Development in Esmeraldas," in: Millennium Ecuador, Iowa University press.

Quiroga, D. 1999. "Sobre razas, esencialismo y salud," in: Ecuador Racista. E. Cervone and F. Rivera (eds.) Quito.

Quiroga, D. 1999. "Los Promotores de Salud y los Discursos Médicos," Revista de la Universidad Andina, Quito.

Quiroga, D. and N. Zabala. 1999. "Production Systems, Population, Health and Consumption in the Upper Amazon," The George Washington Center for International Health.

Quiroga, D. and N. Whitten. 1998. "To Rescue National Dignity: Blackness as a Quality of National Creativity in Ecuador," in: Blackness in Latin America and the Caribbean. N.E. Whitten and T. Arlene (eds.). Indiana University Press. Bloomington, Indianapolis.

Quiroga, D. 1997. "Narrativas Sobre el Diablo," Revista Nariz del Diablo, Quito.

Quiroga, D. and N. Whitten. 1996. "Afro-Latin Americans," No Longer Invisible. Minority Press.

Quiroga, D. and N. Whitten. 1994. "Afro-Hispanic Culture of the Pacific Lowlands," Encyclopedia of World Cultures, Volume 7: South America. New York: Macmillan.

Quiroga, D. 1992. Introduction, Transformaciones Culturales en la Sierra Ecuatoriana. Ed. Norman E. Whitten. Universidad San Francisco de Quito, Quito.

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Quiroga, D. and N. Whitten. 1986. Introduction to the second edition, Black Frontiersmen: A South American Case. Waveland Press, Inc. Prospect Heights, Illinois.

Non-Academic Activities

1980, 1982 Olympic swimmer. Summer Olympics, Moscow. 1980 and 1982 World Games.

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EDUCATION

- **2009** PhD. Department of Zoology Oregon State University Co-advisors Dr. Bruce Menge and Dr. Jane Lubchenco.
- **2001** M.Sc. Marine Environmental Protection, School of Ocean Sciences, University of Wales, Bangor, UK (2000-2001). Advisor Dr. Raymond Seed.
- **1999** B.A. in Biology Faculty of Natural Sciences, Catholic University, Quito Ecuador. Advisors Dr. de Vries and Dr. David Anderson

PROFESSIONAL EXPERIENCE

Nov 09 to present	Assistant Professor, Universidad San Francisco de Quito
Jun 07-Jun 09	Research Assistant, Oregon State University
Apr 07-Jun 07	Teaching Assistant, Marine Ecology and Fish Biology, Oregon State University
Sep 06-Mar 07	Research Assistant, Department of Zoology, OSU
Apr 06-Jun 06	Teaching Assistant, Marine Algae, Marine Ecology Oregon State University
Jan 06-Mar06	Research Assistant, Oregon State University
Sep 05-Dec06	Teaching Assistant Biology 211, Oregon State University
Mar 02- Jun 03	Project Coordinator of a Pew Fellowship in Marine Conservation to Dr. Rodrigo Bustamante for the Galapagos Marine Reserve. Charles Darwin Foundation, Galapagos Islands.
Nov 99- Sep 01	Design, implementation and negotiations with stakeholders to create the Galapagos Marine Reserve. Charles Darwin Foundation, Galapagos Islands.
Jun 97 – Nov 99	Long-term experimental manipulation of herbivores to test the effect of consumers on algal communities Evaluation of the Population Status of sea cucumbers, lobster and fish. Charles Darwin Foundation Galapagos Islands
Oct 95 – May 97	Monitoring breeding success of Nazca Boobies. Mating success and parental effort as factors of sexual selection in Nazca Boobies. Undergraduate Thesis Research

PUBLICATIONS

- Menge B.A. et al. 2009. Terrestrial ecologists ignore aquatic literature: asymmetry in citation breadth in ecological publications and implications for generality and progress in ecology. Journal of Experimental Marine Biology and Ecology. Vol. 377. Pp. 93-100.
- Bustamante, R. and **L. Vinueza**. Marine Iguanas. In: Encyclopedia of the Rocky Intertidal (M. Denny and S. Gaines, eds.). University of California Press.
- **Vinueza L.** G.M. Branch., M. Branch and R.H. Bustamante. 2006. Bottom up consumer and top down El Niño effects on Galapagos rocky-shore communities. *Ecological Monographs* 76: 111-131.
- RH Bustamante, **L. Vinueza**, F Smith, S Banks, M Calvopiña, V Francisco, A Chiriboga & J Harris 2002. Sesile organsims and mobile invertebrates. In: Galapagos Marine Reserve. Biodiversity base line. (Danulat E & GJ Edgar, eds.). pp 38-67. *Charles Darwin Foundation/Galapagos National Park Service*, Santa Cruz, Ecuador.

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- Bustamante, R.H. P. Martínez, F. Rivera, R. Bensted-Smith and **L. Vinueza**. 1999. A proposal for the initial zoning of the Galapagos Marine Reserve, Charles Darwin Research Station *Technical Report.*
- **Vinueza L.** 1999. Mating success and parental effort as factors of sexual selection in Masked Boobies. Bachelor Dissertation. Catholic University, Quito Ecuador.

In preparation

- **Vinueza L.** B.A. Menge, J.P Tiernan, D. Preston and A. Harris (in prep). Interactive effects of stress and herbivory on biomass of primary producers and their associated fauna For Ecology.
- **Vinueza L** and B.A. Menge, D. Ruiz and D. Palacios (in prep). Rocky intertidal community structure in the Galapagos Archipelago: Variation in the influence of top-down and bottom-up effects driven by fluctuations in El Niño Southern Oscillation. Ecological Monographs.
- **Vinueza L, and** B.A. Menge (In prep). Interactive effects of herbivory and productivity on species richness, diversity and evenness of primary producers in Galapagos rocky shore communities. For Ecology
- **Vinueza L. and J.P. Tiernan** (In prep). Conservation status of Galapagos Rocky Shores in the face of human disturbance and climate change. For Conservation Biology
- **Vinueza L** and R.R. Strathman (In prep). The effect of food supply on growth and form of echinoid larvae at temperatures of upwelling and upwelling relaxation. *For Marine Biology.*

CONTRIBUTED PAPERS AND POSTERS

- **Vinueza, L**, B.A. Menge and D. Ruiz 2007. The effect of grazers and productivity on Galapagos Rocky Shore Communities. PISCO meeting, Corvallis, Oregon Dec 10 to 13 2007.
- **Vinueza, L.** and B.A. Menge 2007. Effects of marine iguanas, fish and crabs on the diversity of Galapagos rocky shore communities at different levels of productivity. Trophic structure across ecosystems: Case studies and synthesis. San Jose, California.
- **Vinueza L.** 2006. Conservation ecology of Galapagos rocky shores in the face of human disturbance and climate change. The Humboldt Current System: Climate, ocean dynamics, ecosystem processes, and fisheries. Lima, Peru.
- **L. Vinueza**. The stability of a tropical rocky shore during el Niño event of 1997-1998. Managing for Resilience: An Integrated Approach to Coastal Marine Science and Conservation. August 2004.

COURSES, SEMINARS AND CONFERENCES

- **2005** Biomechanics, Physiology and Genetics of intertidal communities. Summer course at Hopkins Marine Station, Stanford University.
- **2004** Marine Algae and Larval Ecology Summer courses at Friday Harbor, University of Washington
- **2003** Western Society of Naturalists Meeting, Long Beach, California.
- **2002** Multivariate Analysis, Community Analysis (Species Richness and Diversity, Community Analysis Package, ECOM). Given by Peter Henderson -University of Oxford/Pisces Conservation International-Use. March 2002.

FUNDING

Title	*Agency*	*Budget*
Chevening Scholarship Award	The British Government	8,000
FULBRIGHT/OAS/ECOLOGY	OAS-US Department of State's Bureau of Educational and Cultural Affairs	30,000

Zoology Research Fund	Department of Zoology, OSU	1,300
AAUS student scholarship	American Academy of Underwater Sciences	2,500
Iniciativa de Especies Amenazadas "Fernando Ortiz Crespo"	EcoCiencia	2,500
Croasdale Fellowship	Phycological Society of America	1,000
Scott Neotropical Fund	Cleveland Zoological Society	7,530
Idea Wild Grant	Idea Wild	equipment
Lindbergh Grant	Lindbergh Foundation	10,580
Lewis and Clark Exploration Fund	American Philosophical Society	2,000
Conservation Fund	Columbus Zoo and Aquarium	2,000
Rufford Small Grant for Nature and Conservation**	The Rufford Small Grants Foundation	20,000
Grant	World diagnostics	10,000
Bayley Scholarship	Oregon State University	4,800