

Environmental Field Studies Abroad

1995/1996 COURSE CATALOGUE

THE SCHOOL FOR FIELD STUDIES

Semester & Summer
Environmental Field Studies Programs

Wildlife Management Studies – KENYA

Marine Resource Studies – CARIBBEAN

Coastal Studies – PACIFIC NORTHWEST CANADA

Island Management Studies – PALAU

Sustainable Development Studies – COSTA RICA

Rainforest Studies – AUSTRALIA



The world is your classroom

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SEMESTER PROGRAMS & SUMMER COURSES AT SFS CENTERS

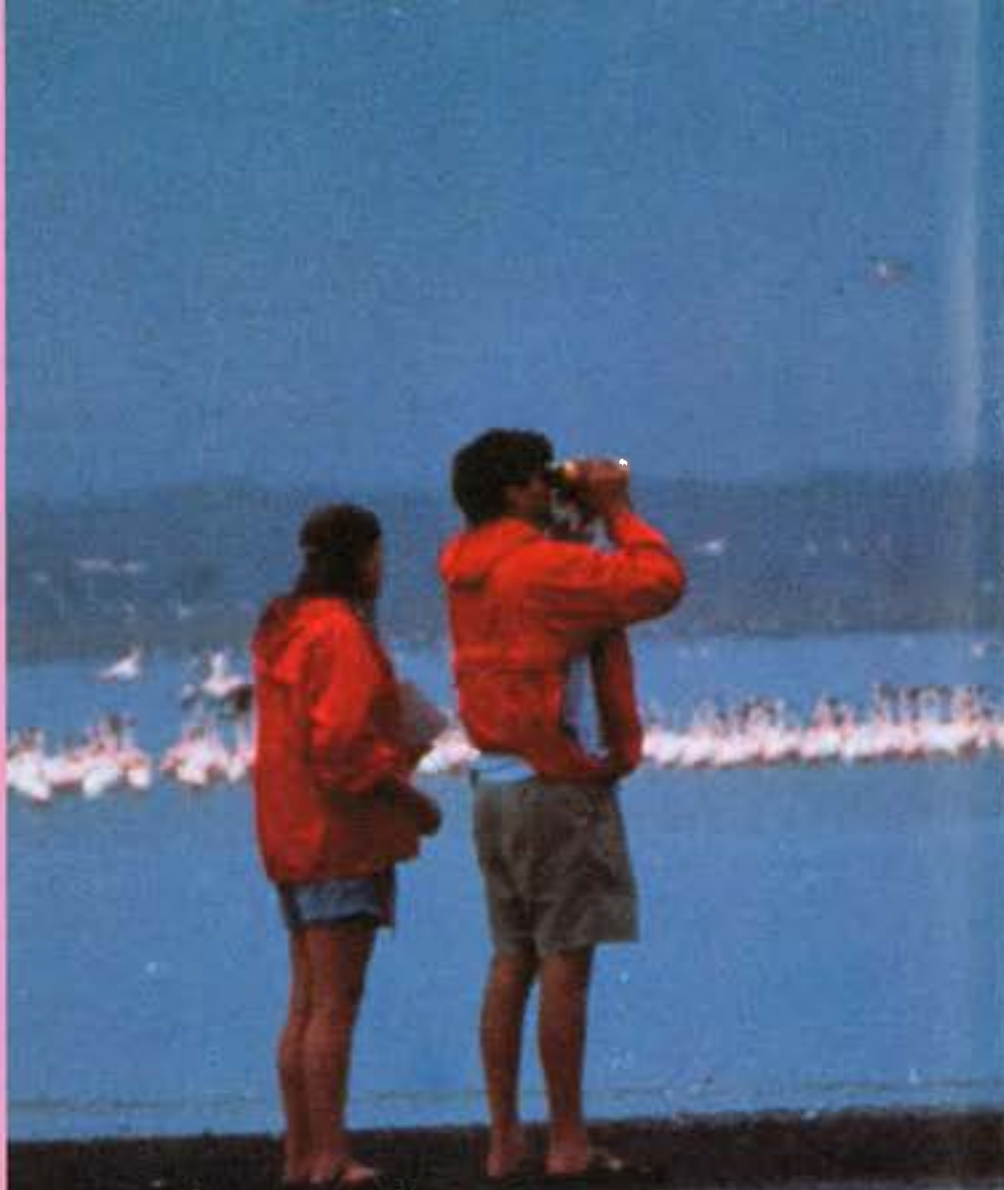
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The Mission
*of The School for Field Studies
is to provide motivated young people
from the U.S. and abroad
with an excellent practical education
in environmental studies,
in order that tomorrow's leaders
may become more environmentally literate
and aware and make immediate and future
contributions toward the sustainable
management of the world's
natural resources.*

Viewing the flamingoes – Lake Nakuru, Kenya.

Photo: Pete Coppolillo



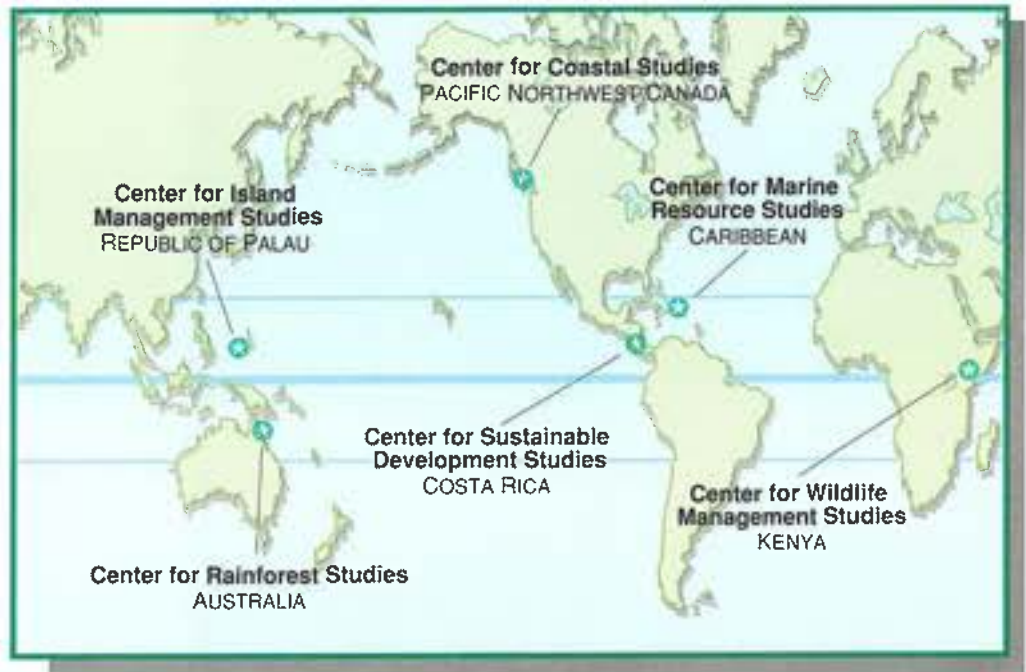
THE SCHOOL FOR FIELD STUDIES

SFS

is the country's oldest and largest educational institution exclusively dedicated to offering undergraduate environmental field courses throughout the world. Since our founding in 1980, more than 6,500 college and high school students, with a variety of academic interests, have had the unique opportunity to conduct hands-on field work addressing some of the earth's most critical environmental issues.

Fall and spring semester programs and intense 30 or 60 day summer courses enable students to earn college credit for participating in real-life field studies of such challenging problems as preserving entire ecosystems or individual species, balancing development and conservation, and finding ways to manage and maintain wildlife and marine resources.

SFS operates six diverse field study Centers, each offering fall and spring semester programs and summer courses. Centers offer us the opportunity to conduct field work on a year-round basis from permanent facilities, enabling us to undertake long term projects and to develop strong relationships with the local community and partnerships with regional management agencies.



SFS CENTERS AND PROGRAMS

The Center for Wildlife Management Studies – KENYA

Semester Program: *Wildlife Ecology & Management*

Summer Course: *Community Wildlife Management*

The Center for Marine Resource Studies – CARIBBEAN

Semester Program: *Marine Resource Management*

Summer Course: *Marine Parks Management*

The Center for Coastal Studies – PACIFIC NORTHWEST CANADA

Semester Program: *Coastal Rainforests & Marine Resources*

Summer Course: *Conserving Marine Resources & Coastal Rainforests*

The Center for Island Management Studies – REPUBLIC OF PALAU

Semester Program: *Island Management Studies*

Summer Course: *Management of Tropical Island Resources*

The Center for Sustainable Development Studies – COSTA RICA

Semester Program: *Studies in Sustainable Development*

Summer Course: *Alternative Strategies for Preserving Tropical Ecosystems*

The Center for Rainforest Studies – AUSTRALIA

Semester Program: *Tropical Rainforest Management*

Summer Course: *Tropical Reforestation*

Letter From the President

Greetings to those of you who are becoming acquainted with The School for Field Studies for the first time and welcome once again to friends who are keeping updated on our progress.

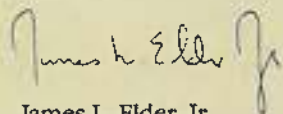
We are buoyed by the ever increasing interest in our environmental field studies abroad programs. We believe that this interest is not only the result of an escalating concern for our environment, but also because of the fact that SFS serves a real need among undergraduates to truly make a difference in their world. We understand that, for our educational model to be successful, we must offer you the opportunity, the theoretical and technical skills, and the self-confidence to make changes that will better the lives of people and their environment. The fact that so many of you are actively seeking out this opportunity instills in us all a great sense of optimism and motivates us to continue to look for new opportunities for you to realize these goals.

This motivation - to have a significant impact at a critical period in time - has led us to our two newest sites. The Center for Island Management Studies in Palau is opening as this developing nation becomes newly independent after 50 years as a U.S. Trust Territory. This is a one time opportunity as decisions made in the next few years regarding development here will irrevocably impact the future of this nation and its spectacular natural resources.

Residents of Clayoquot Sound, Vancouver Island, site of the SFS Center for Coastal Studies, are immersed in a fierce debate over the future of the area's valuable forest and marine resources. Impending decisions on logging here will impact the fate of some of the last temperate rainforests in the world as well as the wealth of marine resources - including oysters, salmon, marine mammals - nurtured in this watershed.

I hope that one of the opportunities presented in this catalogue will motivate you to get involved and to channel your efforts and energy toward ensuring a sustainable future for our global village. The challenge awaits us all, I invite you to accept.

Sincerely,



James L. Elder, Jr.
President



Photo: Robert Bossi

P.S. Our graduates tell us the global perspective, hands-on field experience, team building and critical thinking skills they gained through their SFS experience has made a difference in their lives from academics to career opportunities to personal lifestyles. And they would be happy to share their perspectives with you. To talk with one of our SFS alumni, call the SFS Admissions Office at (508)927-7777.

INTRODUCTION

Ten Reasons To Participate

WHY PARTICIPATE IN THE SCHOOL FOR FIELD STUDIES?

1

LEARN ABOUT ENVIRONMENTAL
ISSUES FIRST-HAND.

2

HELP SOLVE IMPORTANT
ENVIRONMENTAL PROBLEMS.

3

GAIN PRACTICAL FIELD
EXPERIENCE.

4

EXPERIENCE THE REWARDS
OF LIVING IN A NATURAL
ENVIRONMENT.

5

LEARN FROM EXPERIENCED
FACULTY.

6

ACQUIRE VALUABLE
CRITICAL THINKING SKILLS.

7

GAIN EXPERIENCE IN
TEAMWORK AND COOPERATIVE
PROBLEM-SOLVING.

8

WORK CLOSELY WITH PEOPLE
WHO SHARE SIMILAR GOALS
AND INTERESTS.

9

EXPLORE A POTENTIAL MAJOR OR
CAREER AND GAIN JOB SKILLS.

10

EARN COLLEGE CREDIT.

1 Learn about environmental issues first-hand.

Rainforests don't fit under a microscope. Giraffes don't graze in a test tube. That's why The School for Field Studies' programs/courses don't take place in a classroom. We'll take you to the best possible laboratories for environmental studies - the actual ecosystems where problems are occurring. You will experience for yourself dramatic, real-life illustrations of issues that can only be imagined through lectures and textbooks. An SFS educational experience fully integrates theory and practice.

2 Help solve important environmental problems.

All SFS programs use a case study approach to analyze an actual environmental situation or dilemma that requires making a decision about a critical issue. Students engage directly in real-world problem-solving across a wide range of questions: how to strike a balance between development and preservation... control loss of species diversity... feed an expanding world population.

Every SFS program has a local client or partner who has requested or will utilize our work. The data that result from our efforts will become part of databases and management reports for use in decision-making by wildlife officials, government agencies and other environmental organizations. SFS allows you to make a unique, personal contribution to science and our environment.

Photo: Dick Garstang



"A friend of mine attended an SFS program... He was enthusiastic and admitted that although his course was two years before, he still thought of something he learned or someone he met at least once a day. It impressed me that an SFS experience could affect his life in so many ways."

Excerpt from
Anonymous SFS
course evaluation

"Your efforts to find and locate forest Accipiter nests in the area of expansion have been methodical and complete. The District Ranger feels comfortable that negative affects from expansion can now be avoided for these species. Without your students and faculty the Blue Creek drainage would have never received the survey attention that it did receive and the Accipiters nesting there would probably have not been found."

William Hicks
District Ranger
U.S. Forest Service

3 Gain practical field experience. One of our goals is to intro-

duce students to field methodology not available in traditional classrooms. At SFS you will have the opportunity to conduct a directed project from start to finish - formulating a hypothesis, collecting and analyzing data, and presenting your results. You will use many practical field techniques such as tracking, censusing, mapping, sampling, and interviewing. Your results may take the form of a publishable paper, a management plan or a draft policy. You also will gain practical wilderness/outdoor experience and skills.

4 Experience the pleasures and rewards of living in a natural environ-

ment. Much of our field work is carried out in spectacular places - pristine coral reefs, rainforests teeming with biodiversity, fragile mountain habitats - that provide dramatic illustrations of the issues under investigation and renew our motivation to protect our natural resources. Spending an extended period of time immersed in the ecosystem you are studying and meeting the physical challenges of a simple lifestyle - living in tents or rustic field stations, practicing minimum impact camping, recycling and greening - can lead to increased self-confidence and awareness.

"When I visited the SFS program in Australia, I found a group of students who were radiant and content despite the muddy conditions... In college students have labs, in the rainforest they live in the lab seven days a week... Having their subject matter surround them is not only the experience of a lifetime, but one which cannot be duplicated on campus. Over time my students have taught me that mere words cannot do justice to the experience of studying the rainforest in the rainforest. Once I reached the site, I understood why."

Nicole Hamon
Director, Off-Campus
Study - Claremont
McKenna College

Photo: Bill McComas



Photo: Bill McComas



“The faculty were one of the best parts of my experience. They were great teachers who taught us in subtle ways. The teaching didn’t end when the lecture was over; it continued through the afternoons, over conversations at dinner and into the evening. Their perspectives on environmental problems and environmentalism as a field of study were immensely valuable to my development as an environmentalist.”

Patrick Lee
Auburn, MA
Connecticut College

“The SFS experiences have been a marvelous addition to our Biology curriculum at Davidson. Students return to campus with the self-assuredness that comes from having their sense of the world, and their place in it, challenged. Their experiences totally integrate learning and living so that the boundaries of the “academic” world and the “real” world dissolve. They have developed skills in problem-solving, critical thinking and research. In summary, the SFS experience develops leaders, both in and out of the classroom.”

Verna Miller Case
Professor of Biology
Davidson College

5 Learn from experienced faculty. SFS faculty are selected for their interdisciplinary teaching and field experience, knowledge of research or applied environmental problem-solving and interpersonal skills. Given our low student to faculty ratio (no higher than 10 to 1), you will work closely with and learn from these accomplished professionals as they conduct cutting edge field work. Our faculty are accessible, committed to helping you learn, and are successful practitioners of careers to which you may aspire.

6 Acquire valuable critical thinking skills. Faculty from students’ home schools consistently comment that students return from their SFS experience with highly developed critical thinking skills.

SFS will teach you how to approach a real-world problem, to evaluate potential impacts and solutions, and to make difficult decisions without all of the data. In this way, your SFS experience will help you improve your ability to analyze and solve practical problems - skills that will serve you well in your continued education and throughout your life.

“I write to thank you for all the opportunities which SFS has provided me. As a result of that first Kenya semester program, I decided to pursue a career in wildlife management. I returned to Kenya as a Peace Corps volunteer, and then continued working for a local NGO. Since I began my research for my Master’s degree, SFS has been very helpful and encouraging. Now, my Fulbright grant will hopefully enable me to contribute something to the process of developing wildlife management in Kenya. There is much I have to thank you for - no event in our lives occurs in isolation. The support for my project and the process involved to develop it began through being a student here. SFS is a brilliant concept and I wish you the greatest of continued success.”

Heather Eves
1985 Kenya Semester
Participant

Photo: Creighton Peet



7 Gain experience in teamwork and cooperative problem-solving. The team approach to learning and problem-solving is the heart of the SFS educational philosophy and one of our greatest strengths. You will live as a community with responsibility for each others’ well-being and will often work in teams, building on diverse individual strengths to achieve a common goal.

The SFS experience is a journey during which we ask that you be crew not just a passenger. By giving you more control of the educational process - from academics to site management, group dynamics, risk management and community relationships - you not only learn more and participate more but also benefit more from the results.

8 Work closely with people who share similar goals and interests. SFS students come from public and private high schools, colleges, and universities. They major in everything from science to liberal arts. They come from across North America and from

many other countries. They are as young as 16 and as old as 25-26. Approximately 25% receive SFS financial aid from SFS to enable their participation. (See page 38 for financial aid information.)

Although SFS students come from diverse backgrounds, they all share a commitment to learning, a concern for the environment, and a desire to make a real contribution to the future of our planet. A strong camaraderie builds among team members as you share daily challenges—setting up camp, cooking, tackling a tough aspect of research—and as you share thoughts at the end of each day. The experiences you share as you work toward a common goal form the basis of friendships that endure over the years.

Working with people from different backgrounds, under demanding conditions, you will learn a lot about yourself, how you relate as a member of a team, and how you adapt to new people and surroundings. SFS students often say they learn as much about themselves as they do about the environment.

Photo: Jack Shea



“We all learned cooperation and conflict resolution skills... Preparing dinner for 40 on a wood burning stove can be as much of an accomplishment as identifying a fungus on a forest walk. Trying to light a fire under the water tank in the pouring rain so we'd have hot water is a way to bring people together!”

Christie Uchida
Tufts University

“Now that I am back in the States, I realize even more how much I learned in my program in Costa Rica. I am presently taking an ecological agriculture class and when my professor lectures, I can visualize and really understand what he is talking about. It is wonderful to feel that I have real contributions to make to discussions and I now feel I have a strong environmental background.”

Naja Kraus
Clintondale, NY
SUNY at Binghamton

9 Explore a potential major or career and gain job skills.

Students with different academic and career interests participate in SFS for different reasons. For science majors, SFS is a chance to obtain field training before graduation. For students who have little or no scientific background, but are considering a career in an environmental field, SFS is a unique way to see what it's really like. For those who simply want to learn more about environmental issues and help our planet, SFS provides an exciting opportunity to do so.

No matter what their specific interests are, former students tell us that the skills they learned from their SFS experience stay with them, helping them to succeed in school, in their careers, and in their lives.

10 Earn college credit. Upon successful

completion of a SFS program, students receive credit in biology or environmental studies through Boston University, the nation's fourth largest private university, or from their home school if the student attends an SFS Affiliate School. For information on academic credit and a partial list of over 250 colleges and universities who have accepted/ awarded credit for SFS programs, please see page 37.

“The SFS programs are an integral part of the environmental curriculum at Boston University. We have a hard time keeping students on campus! To me, the greatest feature of the SFS programs is their ability to integrate information from many traditional disciplines into a coherent, reasoned analysis of environmental problems. We have undergraduate environmental majors in the natural and social sciences. Students from both programs reap great benefits from the SFS experience that ties important concepts together and gives them a real-world laboratory in which they apply those ideas.”

Cutler Cleveland
Director
Center for Energy and
Environmental Studies
Boston University



Photo: Rich Ruggiero



Our goal is to enable you to come away from your SFS experience with a new understanding of environmental issues, as well as an increased commitment. We particularly want to help you understand the complexity and interrelatedness of all aspects of environmental problems.

We believe that the most effective way to achieve this goal is to offer you, as an integral part of your environmental studies at SFS, a chance to participate in making a meaningful contribution

Photo: Bill McComas



Students in Costa Rica assessing potential economic and conservation impacts of setting aside private land, in this case the habitat for several primate species, as a preserve that would also attract ecotourism.

towards solving environmental problems. To deliver this opportunity, we have created an integrated curriculum incorporating:

- 1 an interdisciplinary, “case studies” approach to teaching;
- 2 problem-solving through field work which aims to provide solutions to local environmental problems;
- 3 involvement in the local community through field and service projects undertaken at the request of a local partner/client; and
- 4 participation in an educational journey during which you are asked to be a member of the crew, not a passenger; where we expect and encourage you to take a proactive role in all aspects of your education.

1. The interdisciplinary, “Case Studies” approach to teaching.

All SFS programs begin with an investigation of one or more local environmental problems in the form of a case study. A case study is an analysis of an actual (not simulated) environmental problem which requires that a decision be made. Drawing from a number of disciplinary perspectives (usually ecology, resource management, economics, applied anthropology, and political science), we study those theories and tools that are relevant to understanding a particular complex problem. In each case study, we seek to identify ways in which natural resources can be developed economically in a manner which can be sustained indefinitely, a concept known as sustainable development.

Faculty lectures and readings provide theoretical information necessary to understand the problems raised by the cases. Guest lectures by individuals who are often intimately involved in the issue under study provide a rich (and, at times, conflicting and confusing) context which is typical of major social problems. Practical, interdisciplinary activities enable us to gain hands-on experience as we address these issues.

In the course of the case study, you will be faced with making a decision, usually in the face of less than complete data and less than perfect solutions. For example, in Kenya, the elephant problem has become a defining international image of wildlife management. The politics of international conservation have run headlong into issues over national sovereignty. Our case study on the effectiveness of the ivory ban as a way to manage the elephant population challenges you to reconcile local economic needs with national and international conservation interests.

Faculty routinely lecture together and cooperate in field exercises. Courses are integrated with fieldwork assignments and other activities. Debates, policy statements, or management plans are often used in the concluding and evaluative stages of the case study. The goal of the case study approach is to integrate the lectures, discussions, debates, and field trips into a nearly seamless academic experience.

2. Learning problem-solving through field work which aims to provide solutions to local environmental problems.

All SFS programs include a field research component. This component provides you with an opportunity to make an immediate contribution to the improvement of a local environmental issue and, at the same time, to put the theories you are learning in the classroom into practice. The School's mission does not seek to promote research for its own sake. Rather, we seek to produce first-rate applied research in the form of practical reports to local resource managers as an essential part of our educational process.

You will have the opportunity to design and carry out a field project related to the current goals of the Center or program. These projects usually last for more than half the program, culminating in presentations to both the local community and the larger outside community of scientists, researchers and representatives from SFS partners and clients.

3. Involvement in the local community through field and service projects undertaken at the request of a local partner/client.

Case studies and field work can only be successful if we develop solid partnerships and client relationships with local individuals, organizations, and agencies interested in conservation: our program partners. Our clients are those stakeholders for whom the environmental issue under study has a personal impact on their wellbeing. Our partners are working on those critical local environmental issues related to the Center which will provide suitable material for an applied education.

In addition, you may engage in environmentally related community service projects outside the formal academic curriculum. In South Caicos for example, SFS students, led by a faculty member, started a science club at the High School. Club members in turn helped our students stage a "SEA DAY" at the Center, when all the island children come to the Center to learn more about their surrounding ocean environment.

4. Participation in an educational journey during which you are asked to be a member of the crew, not a passenger; where we expect and encourage you to take a proactive role in all aspects of your education.

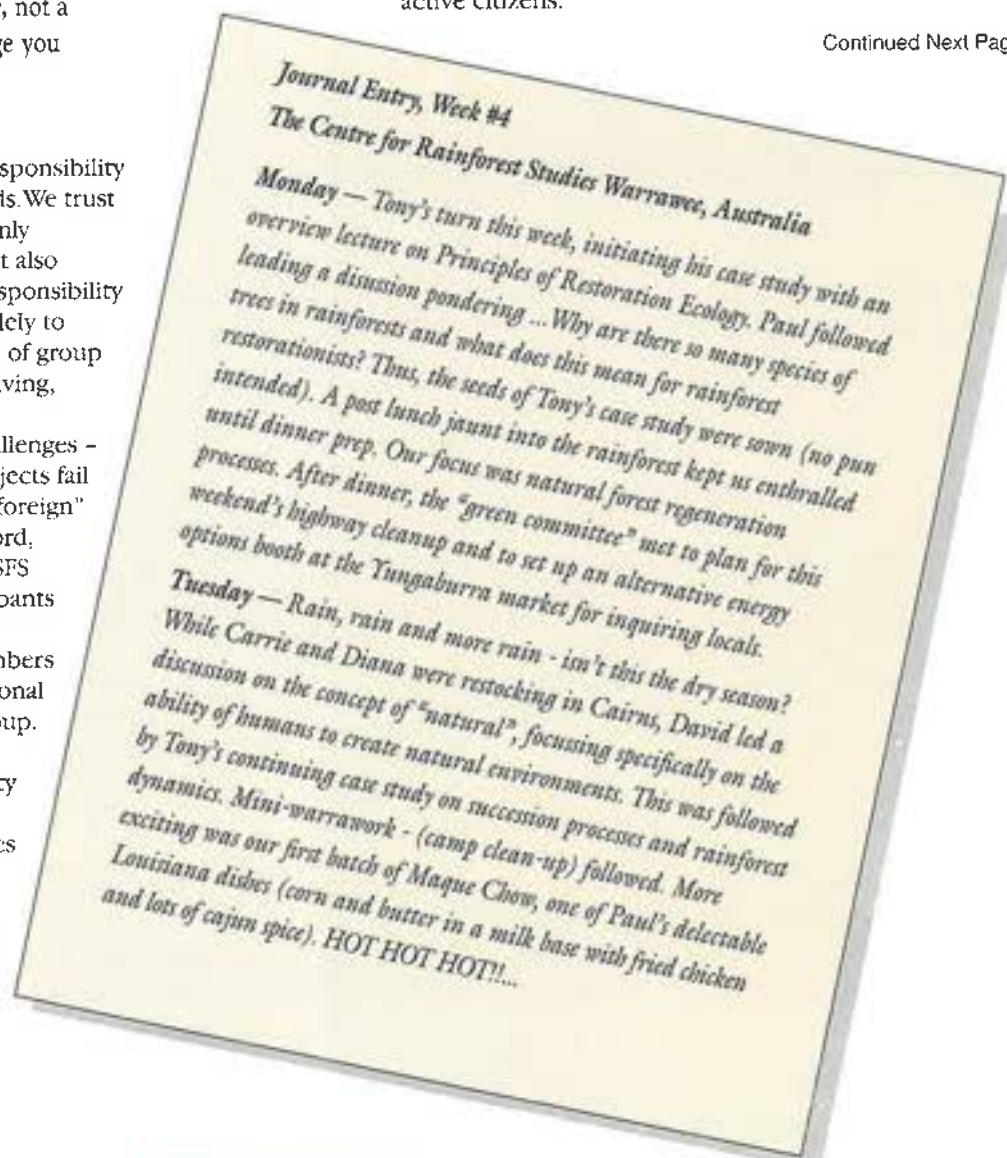
We seek to put some control of - and responsibility for - your educational process in your hands. We trust that, if given this opportunity, you will not only participate more fully in your education, but also benefit more fully from the results. Your responsibility to learn in an SFS program is not limited solely to academic study; it extends to many aspects of group dynamics, community relationships, daily living, and institutional relations.

Field work can be fraught with daily challenges - tools and equipment break down, field projects fail for reasons outside of your control, and a "foreign" environment, in almost all senses of the word, creates obstacles as well as opportunities. SFS teams often live in isolated settings; participants spend up to three months living in close proximity with up to forty other team members and may, at times, be asked to give up personal freedoms for the good and safety of the group. Identifying effective solutions to environmental problem-solving requires a sensitivity to, and an understanding of, the local context. Mastering these challenges requires developing problem solving, team and relationship building and risk management skills that are useful long after you leave the field.

As a result of SFS experience, we are hopeful that an SFS graduate will have developed:

- an integrated understanding of the relevance and application of select principles of: ecology and conservation biology, resource economics, resource management, cultural history, political science, social ecology, and ethics related to environmental problems;
- the problem-solving, critical thinking, and communication skills necessary to enact change;
- the personal confidence and self-sufficiency to accept responsibility for his/her own personal decisions, learning and growth;
- the conviction that one person can make a difference, especially by getting others involved and working together;
- the confidence to work toward solutions for complex environmental problems;
- and the realization that each individual has a responsibility to a larger community, requiring each of us to be informed and active citizens.

Continued Next Page



The goal of our conservation focus is to create projects at each Center that provide solutions to real environmental problems at the local and regional level and that offer models for creating policies, methodologies, and planning tools to deal with global environmental problems. Conservation projects undertaken by SFS teams in 1994 have resulted in:

- the planting of over 8,000 trees, (started as seedlings at the Center for Rainforest Studies), adding to the thousands planted over the past four years at the once denuded Pelican Point peninsula in northern Queensland. Some previous plantings here are already over 12 feet tall and are acting both as a windbreak to reduce soil erosion and as wildlife habitat corridors.
- recommendations for low cost traps for white flies as well as land management practices to control this pest without relying solely on pesticides. Solutions to the white fly threat are increasingly important as Costa Rica moves to introduce early-ripening varieties of mango for delivery to U.S. markets at the peak of demand, which is the same time white fly numbers are at their peak.
- the hosting of a conference to help to establish a conservation agenda for the Turks and Caicos Islands; the production of a visitors's guide to Cockburn Harbor encouraging environmental protection and describing an underwater snorkel trail developed by SFS students; and the production of a poster for use in identifying undersized lobster and conch to reduce illegal and unsustainable harvesting of these species.

In addition, papers based on directed research projects have been presented by SFS students and faculty at international conferences in 1994 including:

- "*Coffee Production Technology and Energy Efficiency in Costa Rica: What is the Real Cost?*" by co-authors Stephanie Katz (Boston University), Brian Silinski (Allegheny College) and SFS faculty Bernardo Aguilar, and "*An Economic Valuation of Carara Biological Reserve: Potential Protected Areas in Costa Rica*", co-authored by Kate Besleme (St. Olaf College) and Mr. Aguilar, were presented at the International Conference on Ecological Economics.
- "*The Dynamics and Interactions of Two Pests of Mango, *Anastrepha Obliqua* and *Ceratitis Capitata**", co-authored by Camillo Carmargo (University of Pennsylvania) and Dr. Lisa Bradshaw, was presented at The Fifth International Congress on Integrated Pest Management.

SFS SEMESTER PROGRAMS

Curriculum

Fall and spring semester programs at each Center run for 14 weeks and enroll up to 32 students. To facilitate credit transfer, we have separated the lectures and field work in the integrated semester curriculum into four separate university courses, each carrying 4 semester credits. Three of these courses (*usually incorporating an ecological, resource management, and socio-economic or applied anthropology perspective*) focus on theory using local examples. Each involves the traditional elements of an undergraduate course including more than 50 hours of lecture, readings, written assignments, exams, field trips, oral and written evaluations. The fourth course, Directed Research, involves over 150 hours of coursework including instruction in research design and completion of an individual field project addressing a component of the semester's research objective. (*Please see page 34-35 for individual course descriptions*).

Schedule

Semester programs run for at least 90 days not including a four day midterm break (*the only time you are free to travel on your own*). We compress a 16 week semester into 14 weeks (*by working on weekends among other methods*), so be prepared for an intensive learning process.

The program begins with a ten day-long introductory module orienting you to the site and the local environmental issues. An average of three weeks is allotted to each of the case studies. Several days at the end of these periods are set aside for synthesis and evaluation. The program ends with a 'Re-Entry' Module which offers us an opportunity to reflect on the experiences of the semester, clarify values and consider career possibilities.

Our schedule varies throughout the semester. The first half of the semester will include approximately 15, one to one and one half hour long, lectures a week plus 3-5 other meetings (*organizational, research/paper presentations, guest lectures*). Afternoons are generally filled with field trips or laboratories. Academic activities are usually held six days a week. On average, we will spend 3-4 weeks of each semester off-campus on field trips. (*Students at the South Caicos and Palau Centers spend significantly less time off-campus*).

Later in the semester, there will be fewer lectures and organized classes and more time is allocated for Directed Research projects. Additional meetings offer training sessions in the skills (*statistics, paper writing formats, computer spreadsheets, and laboratory analysis*) needed to complete your research.

In addition to daily chores like kitchen duty, several hours are scheduled each week for a thorough site clean-up.

Prerequisites

Semester participants must be at least 18 years old, must have successfully completed at least one college level ecology or biology course, and should have completed at least one semester at a college or university. Other prerequisites may apply; please be sure to check individual program descriptions.

SFS SUMMER PROGRAMS

Curriculum

SFS offers summer programs at all Centers. Students in summer programs focus on a single case study. *(Please see page 6 for a detailed case study description).*

Each program involves elements of an undergraduate course including more than 40 hours of lecture, readings, written assignments, exams, field trips, oral and written evaluations. In addition, you will have the opportunity to design and carry out a field project related to the current goals of the Center or program. These projects usually last for more than half the program, culminating in presentations to the local community and interested scientists and representatives from SFS partners and clients.

Schedule

Most SFS summer programs run for 30 days, enroll 32 students with four faculty, and are accredited for 4 semester credits in biology or environmental studies. We also offer several sixty day programs comprised of two courses: a theory course (4 semester credits) and a Directed Research course (4 semester credits).

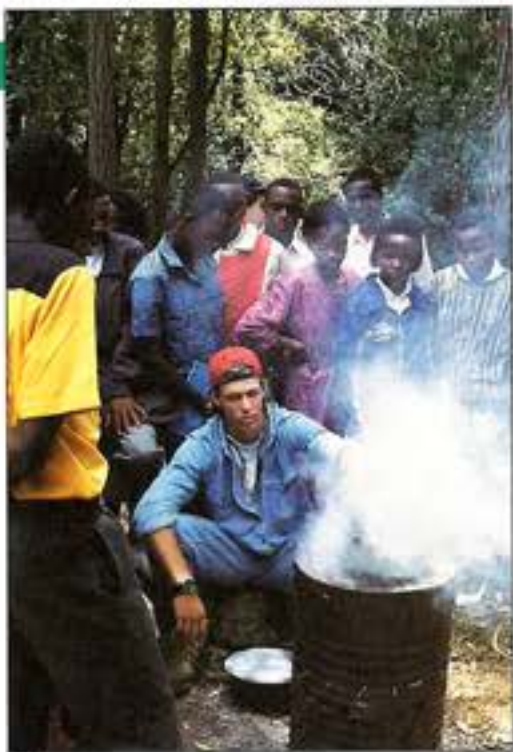
You will be involved in activities seven days a week in 30 day summer programs with only one or two days off during the program. These courses run from mid-June to mid-July and from mid-July to mid-August. Sixty day programs run from mid-June to mid-August with a 3 day midterm break *(when you may be free to travel on your own, depending on the program)*. In either case, be prepared for an intensive learning process.

Our daily schedule will vary from course to course, depending on research agendas, weather, field trips and logistics. Typically, we awaken early and either attend a morning lecture or head out to the field. We will devote much of the day to field work, returning to the Center in the late afternoon to process our data, or if we haven't already done so, to participate in our daily lecture. After dinner we may have a guest lecture, group discussion or study time.

Later in the course, we spend less time in lectures and more time working on directed field projects. Additional meetings may be scheduled to offer training in skills *(statistics, paper writing formats, computer spreadsheets, and laboratory analysis)* needed to complete your research. Everyone should expect to be involved in kitchen/cooking duty and site clean-up.

Prerequisites

Summer courses are taught at the college introductory level. Our low student to faculty ratio and interactive teaching approach allow us to adjust the content and pace of the course to suit the needs of the team. While most summer participants have completed at least one college biology or ecology course, talented and motivated students with no ecology background have had comparable academic success. To apply to a summer program, you must be at least 16 years old by the time the program begins, and must have successfully completed at least the junior year of high school. Other prerequisites may apply; please check specific program descriptions.



SFS student demonstrating a model dung cooker developed at the Center for Wildlife Management Studies in Kenya as part of a directed research project examining options to reduce reliance on wood for cooking.



Photo: Beth Bader

A local government official recently noted that "Since SFS has been on South Caicos, grades on high school science exams have gone from last in the country to first and I believe SFS's presence in the community and work in the schools is primarily responsible."

KENYA

CENTER FOR
WILDLIFE MANAGEMENT STUDIES

CENTER PROGRAMS

Wildlife Ecology and Management

Semester Program — Page 12

Community Wildlife Management

Summer Course — Page 13

Center Objective

To develop scientifically sound and culturally and economically appropriate guidelines for managing game on the Kenyan plains that respect both the country's need for agricultural production and its history and identity as a famous home for wildlife.

Critical Environmental Issues

Kenya's reputation and reality are on a collision course. Its need for food has so stressed its patterns of land-use that huge tracts of wildlife habitat have been reallocated to food production. Reductions in habitat size and destruction of migration corridors threaten the survival of wildlife populations — and the tourist industry based on them. Moreover, current methods of food production such as cattle ranching are unsustainable and will require sacrificing yet more land. Wildlife, Kenya's chief natural resource, may provide an ecologically appropriate solution to the dilemma — but first these questions must be answered:

- ◆ What is the status of existing wildlife populations?
- ◆ Which current land-use patterns are sustainable?
- ◆ How can the co-existence of wildlife and humans be encouraged?
- ◆ What are the cultural and economic barriers to changing land-use patterns in rural Kenya?

Center Clients/Partners

Our data will be used by the Kenya Wildlife Service, which is charged with conserving and commercializing the country's parks, and by private organizations hoping to assist this shift in Kenya's economy, such as the World Bank and the World Wildlife Fund. Private raisers of game (*including Game Ranching Ltd., the home of our Center*) welcome our research into the ecological impacts of game ranching. Our findings may also be of use to tribal cooperatives seeking alternative methods of food production.

Field Director: Toni Jackman, M.S., Wichita State University (*Geology*).

Resident Faculty: Richard Hatfield, M.S., Cornell University (*Agricultural Economics*) and M.I.M., American Graduate School of International Management.

Derek Berliner, M.S., University of Witwatersrand (*Ecological Modeling*).

Wayne T. Voss, Ph.D., University of Natal (*Botany*).



Site Description

Kenya's stark and beautiful countryside deserves its stunning reputation. Authors and adventurers from Hemingway to Dinesen have mesmerized us with its harsh desert, arid plains, gentle savannas and dense rainforests. These provide the stage for an astonishing variety of wildlife: antelope, zebra, rhino, and elephant, as well as the lions, cheetahs and leopards which prey on them.

Kenya sits astride the equator. This not only makes for days and nights of equal length — unfamiliar enough to



Photo: Dick Garstang

"I can't recall a class where one couldn't look up and see a giraffe, oryx, eland or kongoni less than fifty meters from the classroom. This setting offered us a 'hands-on' laboratory where the examples we discussed in lecture could be explored up close immediately after class."

Colinnee Bartel, Wooster, OH - UCLA

most North Americans — it also prompts abrupt, vivid sunrises and sunsets of breathtaking color. Darkness arrives by 7 p.m. every night of the year and then the African sky offers up a stunning panorama of unfamiliar stars. Our familiar constellations may be visible, but they skirt the northern edge of the sky.

The shock of the unfamiliar can be a daily companion at Jua Kali, our field station based in a remote corner of an experimental game ranch on the high

Center For Wildlife Management Studies

Photo: Michelle Gadd



Students and faculty examine a skeleton found on safari.

plains. Eland and Grant's gazelle wander freely through our cluster of thatched roofed huts. The acacia trees surrounding our rustic compound are a favorite snack of local giraffes. You may look out from our open-sided lecture hall to find one of these slender giants blocking your view.

The wildebeest, zebra, impala and fringe-eared oryx roaming the ranch remind us hourly that we are in Africa. To complete the picture, Mount Lukenya dominates the eastern horizon; Dinesen's beloved Ngong Hills lie due north.



Photo: Pete Caspell

Our field work will include investigating cultural, economic and practical barriers to wildlife ranching as a sustainable land-use option. In doing so we must determine rural residents' attitudes toward purchasing and eating game.

Center Facilities

Our Center for Wildlife Management Studies is based at Game Ranching Ltd., a forty minute drive from Nairobi. The main headquarters of this 81-square kilometer ranch lies several kilometers from our rustic isolated camp. Students sleep in bandas, traditional thatched roofed huts. An open dining/lecture hall, library, outhouses and open-air shower complete our base camp.

Living and Working Conditions

Days follow a structured pattern early in the program: Mornings are reserved for lectures, afternoons for field work, and after-dinner hours for presentations and guest lectures. But this schedule will soon be disrupted; we plan to make extended field trips (three during a semester and one during summer courses) of at least a week each to sites in other parts of the country. When we are at the Center, time is set aside each week for maintenance work and community service projects. Toward the end of the term, our schedule becomes more flexible as directed research and data gathering fill our days.

Even at rest, we will seem on safari; there is no telephone, computers are strictly lap-top, and vehicle access is entirely by four-wheel drive. We will prepare most meals, with the aid of a local cook; food stuffs are Western with an African influence (the Kenyan



Photo: Dick Gertling

Our challenges include finding appropriate research methodologies for our field work such as this bird observation tower, designed and built by students using locally available materials. Student bandas (living quarters) can be seen in the background.

traditional diet lays heavy emphasis on animal protein, but we make an effort to procure fruit and vegetables). Game meat from animals raised and slaughtered on the ranch provides occasional unusual meal options.

Despite our equatorial location, the climate is temperate. Days can be hot, with temperatures rising into the high 80s; nights are cool enough for sweaters. From January to March, there can be 10 hours of cloudless sunshine in a 12-hour day; as April approaches, the rainy season begins.

Members of the Center staff belong to several Kenyan tribal groups, including the storied Maasai. Our field-trips and discussions with management officials will bring us into contact with other tribal groups and indigenous communities, providing exposure to the multifaceted basis of Kenyan rural society.

Continued Next Page

K E N Y A

WILDLIFE ECOLOGY AND MANAGEMENT

Program Dates:

September 9 - December 12, 1995
February 1 - May 7, 1996

Departure Point:

Nairobi, Kenya

**Students will be registered
in four academic courses:**

- BI/EE (NS) 371 Techniques of
Wildlife Management
- BI/EE (NS) 372 Wildlife Ecology
- EE (SS) 302 Environmental Policy and
Socioeconomic Values
- EE 491 or 492 Directed Research

Please see pages 34-35 for course descriptions

Introduction

The habitat required by Kenya's wildlife, its most famous and most economically valuable resource, is increasingly threatened by the country's soaring rate of population growth - the highest in Africa. So many people, in such an arid country, must struggle to raise enough food just to survive. Kenya's traditional land allotment practices and the immense cultural importance of beef cattle now place tremendous stress on its agricultural land.

One result has been massive reallocation of formerly protected wildlife range, which has reduced habitat and undermines the long term viability of Kenya's irreplaceable wild animal populations. These animals are a magnet to tourists; more than a half-million visit each year and supply the country's primary source of income. Clearly, ecologically appropriate solutions to the conflict between food production and wildlife habitat must be found.

We will begin the semester with a 10-day overview introducing the problem-oriented case studies approach and the environment and ecological concerns of Kenya before examining three case studies and pursuing direct-research projects which integrate material from the three courses.



Photo: Michelle Gadd

Case Study #1:

**How can local communities live
with wildlife?**

The tremendous strain placed on land in Kenya by its burgeoning population has pushed the government into reallocating public land to private land, and also directing tribal owners to farm the savanna for agricultural use. The wildlife which formerly roamed across an expansive range now finds itself hemmed in by human settlement. At Lake Nakuru, one of our field trip sites for example, demand for access to fresh water has created a ring of disturbance completely enclosing a narrow wildlife range along the shore. We will compare the situation in Kitengela Conservation Area, a protected region adjacent to our Center, and sites we visit during field trips. Using censusing and habitat assessment techniques, we will compare wildlife conditions at several sites. Interviewing community members will help us to assess attitudes toward wildlife as part of our efforts to determine whether economic and cultural incentives can be created to promote wildlife conservation.

Visits to two Kenyan parks - Tsavo West and Amboseli - provide dramatic illustrations for our case study of the dilemma of elephant management.

Case Study #2:

**What are the most viable strategies
for managing elephants?**

Two major Kenyan parks - Tsavo West and Amboseli - provide examples of the dilemma of elephant management. In Tsavo, the elephant population is slowly climbing back after declining precipitously in the 1960s. Here vegetation is now luxurious and other wildlife is abundant; lions roar at night near our campsites. In Amboseli, elephants are abundant - a slow-moving elephant herd may completely surround our vehicles on an Amboseli road. A large elephant population creates a landscape that is lunar-like in its starkness and other wildlife are often seen as carcasses after dying from starvation. The Kenyan government's policy toward elephant management is strictly hands-off. By contrast, neighboring Zimbabwe culls elephants to balance park wildlife.



Photo: Michelle Gadd



K E N Y A

COMMUNITY WILDLIFE MANAGEMENT

Program Dates:

Session I: June 13 - July 12

Session II: July 19 - August 17

Departure Point:

Nairobi, Kenya

Course Number: EE (NS) 350

Off-ranch safaris provide opportunities to confront the environmental problems facing Kenya first-hand. "Through my classes and these safaris, I was afforded a very whole vision of the issues facing conservationists and was able to develop my ability to think critically and beyond readily available media perspectives."

Rachel Bridgewater, Warner, NH
Simon's Rock of Bard College

These contrasts spur an immense controversy over the proper methods for managing elephant populations and ecosystems in a sustainable manner. We will make an extended safari to these parks to assess this contrast and learn the perspectives of regional wildlife managers. We can then explore options, including the ivory trade ban, for sustainable management of this emotionally focused and ecologically important wildlife species.

Case Study #3:

What are the impacts of commercializing wildlife?

Game ranching, originally seen as the obvious solution to the problem of inappropriate agricultural techniques in Kenya's harsh environment, has not fulfilled its early promise. It remains largely the province of whites, and has not penetrated tribal culture. This is despite many tribes whose traditional inheritance practices have diced their land into agricultural uselessness and who now sorely need an alternative protein source. In the context of field trips to ranching establishments and in discussion with native experts on wildlife, we will explore whether wildlife is the most appropriate and sustainable land-use option. Utilizing economic analyses and anthropological interviewing techniques, we will investigate cultural, economic and practical barriers to wildlife ranching. Part of our work will be to determine rural residents' attitudes toward purchasing and eating game meat, as well the nutritional value of game meat for human consumption given protein content and parasite loads.



When thinking of Kenya, one often has visions of giraffes, zebras, lions and elephants. A number of SFS students have focused their field work on some of Kenya's spectacular bird species, such as the raptor shown here at our basecamp.

Case Study Question:

Will developing Kenya's chief indigenous resource, its wildlife, as a food source provide a sustainable solution to this conflict between Kenya's need to feed its rapidly growing human population and the desire to conserve wildlife populations?

Field Work Focus

- ◆ Determining whether land-use strategies now in place are ecologically sustainable.
- ◆ Investigating the tribal and cultural factors affecting land use in Kenya.
- ◆ Exploring stresses on natural resources caused by game ranching.
- ◆ Exploring cultural and practical barriers to raising, purchasing and consuming game meat.

Educational Objectives

We will research potential solutions to the conflict between current wildlife

management practices and traditional land-use practices. Reconsidering wildlife, as sources of food as well as objects of tourist enthusiasm, may provide a sustainable land-use option.

Faculty lectures introduce African climatology, animal identification and social organization, plant/herbivore interactions, and theories of island biogeography. Guest speakers may include experts in ecology and East African history as well as local game ranchers discussing range management techniques.

Field work on the ranch exposes us to mapping, vegetation analysis, animal population censusing, statistics and biometry, behavioral observation and sampling. During field trips to national parks, we will meet with park managers and have an opportunity to compare behavior and productivity of wildlife in confined and free-ranging populations. Interviews with community members provide insight into cultural perceptions that may influence our recommendations.

CARIBBEAN

CENTER FOR
MARINE RESOURCE STUDIES

CENTER PROGRAMS

Marine Resource Management

Semester Program — Page 16

Marine Parks Management

Summer Course — Page 17

Center Objective

To assist local managers in developing scientifically sound, culturally acceptable, and politically and economically feasible policy recommendations that will result in the sustainable development of the marine resources of the Turks and Caicos Islands.

Critical Environmental Issues

Developing sustainable fisheries is an immediate concern for this fishing community. In addition, funding for a new national parks system, the Admiral Cockburn Land and Sea Park, was approved in 1992. The new National Parks Department must determine how to develop and manage the park for the use and benefit of residents without degrading the valuable marine resources. At the same time, the park and natural resources are drawing developers of second homes and resorts whose efforts may stress the very resources which drew them here initially. There are many questions that must be answered in the process of developing a park management plan:

- ◆ What are appropriate levels of coastal development?
- ◆ Can the Park provide a means to supplement the nations' economy?
If so;
- ◆ How can a marine park be used to encourage tourism?
- ◆ What are sustainable levels of harvest for lobster and conch?
- ◆ What is the potential for sustainable exploitation of
shallow water reef fish?

Center Clients/Partners

The National Parks Department, the British Overseas Development Administration and the TCI Department of Fisheries have actively solicited SFS input in conducting baseline resource assessments, fisheries research and in the development of a resource monitoring program for South Caicos and the surrounding waters. Faculty and students at the Center are in a unique position to contribute to policies and decisions that will influence growth and development here.

Field Director: Frank Bonaccorso, Ph.D., University of Florida (Zoology).

Resident Faculty: Sascha Steiner, Ph.D., University of Vienna (Zoology).

Derek Carrington, M.A., University of Waterloo
(Regional Planning and Resource Development).

Andrew Gude, M.S., Portland State University
(Natural Resource Management).

*SFS gratefully acknowledges the Curtis and Edith Munson Foundation
for their generous support of this Center.*

Site Description

The Turks and Caicos Islands (TCI) lie south of the Bahama Islands, approximately 100 miles north of the Dominican Republic. The islands represent the surface exposure of the Turks Bank and the Caicos Bank. At South Caicos, the bank plunges 7000 feet into the deep ocean abyss, and to the west, a vast shallow bank area, averaging 10 feet deep, stretches for nearly 60 miles. This highly productive area supports one of the world's largest spiny lobster and conch fisheries.

From the air, the local waters appear as a patchwork of blues and greens. This mosaic effect is caused by the variety of marine habitats - seagrass beds, mangrove swamps, sandy shoals, patch reefs, fringing reefs and deep reefs



Photo: Bob Singer

"Our directed research projects are run in conjunction with the Fisheries Department for use in their management decisions. This work won't die in a folder on a professor's desk, but will be passed on to local agencies for their use."

Jesse Williams, Richmond, VA - Middlebury College

From its perch atop a small bluff, the Center looks out over clear blue waters with nothing but open ocean all the way to the African coast. "We had to know and identify all of the fish, 60 species of invertebrates, and 35 species of corals. Every time we were in the water snorkeling or diving, we were essentially doing our homework!"

Matt Weedon, Irving, Texas – Austin College

- that surround the islands. Diving into the clear turquoise waters, where visibility is often over 100 feet, one is amazed at the beauty and variety of fish and invertebrate species. Over 40 species of corals and 100 species of fish have been identified on the reefs including southern stingrays, eagle rays, several shark species, and grouper. The islands are inhabited by lizards and birds, and are nesting sites for hawksbill and green turtles.

Center Facilities

The SFS Center is based in a former hotel on the southern edge of South Caicos Island. Perched atop a small bluff, the Center overlooks clear Caribbean



Photo: Jim Elder

waters and undeveloped offshore cays as well as the town of Cockburn Harbor. The Caribbean-style architecture uses shade and trade wind ventilation to cool the rooms. A rainwater catchment system supplies water, a precious commodity here. A Center goal is to operate as sustainably and self-sufficiently as possible in its use of natural resources.

The main Center facility has a large, brightly painted dining area, kitchen, classroom, and a library/computer area. Each of the eight residence rooms houses four students and has a bath and an often necessary ceiling fan. We are fully equipped for marine operations with a private dock, five boats and a commercial SCUBA compressor. The site affords easy access to shallow expanses of turquoise waters or to the deep blue of the open sea.

Living and Working Conditions

A typical day during the first half of the program includes 2-3, hour-long, morning lectures.

Afternoons are devoted to field work, usually comprised of data collection using SCUBA or snorkeling, or, since we won't be diving every day, a field trip. Evenings may include a guest lecture, presentation or workshop.

Time is set aside each week for center maintenance and for local community service projects. During the second part of the term, we will have fewer lectures and classes and more time is allocated for directed research projects. Free time is limited but there will be opportunities through coursework, community projects and recreation to get to know the friendly local residents.

This is a true tropical climate with hot (80-90's) days and warm (70-80's) nights. Tradewinds keep our rustic site comfortable and free of biting insects throughout most of the year. Ocean temperatures average in the upper 70's. Many of our field work sites can be accessed by snorkeling. When we dive, it will usually be in waters under 60 feet deep, although we will try to visit the drop off for deeper dives a few times during each program.

Although the Center employs a cook, we will all participate in kitchen duty. Meals primarily consist of simple food (rice, beans, canned fruits and vegetables) provided via regular shipments from the U.S.

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Photo: Beth Bader

On SEA DAY, local children come to the Center to learn more about their ocean environment. SFS students have also started a science club at the high school.

SOUTH CAICOS ISLAND MARINE RESOURCE MANAGEMENT

Program Dates:

September 9 - December 12, 1995

February 1 - May 7, 1996

Departure Point:

South Caicos Island, BWI

Students will be registered in four academic courses:

- BI/EE (NS) 373 Tropical Marine Ecology
 EE (NS) 374 Principles of Resource Management
 EE (SS) 302 Environmental Policy and Socioeconomic Values
 EE 491 or 492 Directed Research

Please see pages 34-35 for course descriptions

Note: SCUBA certification is required for semester participation. Divers must bring their own SCUBA and snorkeling equipment, although weights and tanks may be rented on site.

Introduction

The Turks and Caicos Islands (TCI) were once the world's largest exporter of conch and an important exporter of spiny lobster; both are important as sources of local income. South Caicos has been the country's most important port for the fishing industry, the economic mainstay of the area. Potential depletion of the fisheries has become a major concern with impacts on employment and social structure.

Throughout the Caribbean, communities have encouraged growth of tourism as a means to diversify and strengthen their economies. This has often led to rapid social, economic and ecological change. Tourism and development are poised to become major issues for South Caicos. Rapid development may offer residents short term financial gain while threatening the island's resource base. If the TCI are to escape the detrimental environmental effects of development, similar to those occurring elsewhere in the Caribbean, management plans for conserving marine resources must be initiated without delay.



Photo: Pam Buckman

We begin the semester with a study model introducing the problem-oriented case studies approach and the environment and community of South Caicos and then spend the remainder of the semester examining three specific case studies and undertaking directed field projects integrating material from our three courses.

Case Study #1:

What management strategies will sustain the park ecosystems of South Caicos?

The reefs surrounding the TCI provide excellent habitat for fish and lobster, the shallow banks are sources of conch. The reefs also attract tourists, the greatest source of potential new revenue. The reefs are under assault from many sources - pollution, global warming, diver and boat damage, dredging, dumping and construction and over-fishing of key organisms. The establishment of parks can save some of these delicate ecosystems, but would force traditional fisheries to look for other "unprotected sites", simply moving the problem. We will focus on the identification of natural resources,



Photo: Bob Singer

"Not only do I now know what it is like to get down on my hands and knees in the dirt to search for data. I also know what it is like to analyze data, write a clear research report and stand up in front of a group to present my findings."

Heather Curston,
Elgin, TX - Trinity University

the assessment of their present exploitation, and the introduction of management strategies to successfully set up marine parks. Lectures and readings on the ecology and life cycles of marine communities will prepare us to conduct resource inventories of the reefs. The role of the departments of fisheries and parks in the local economy will also be discussed as will the socio-economic aspects of marine parks development and management.

Case Study #2:

How can a sustainable level of conch, spiny lobster, and fin fish be maintained in the South Caicos fishing industry? Can this approach be applied to other Caribbean islands and their fishing industries?

We will examine the island's primary economic force - the lobster and conch fisheries, focusing on resource sustainability. After conducting field measurements of population size and distribution, we will discuss concepts of sustained yield and strategies for stock enhancement. Visits to lobster and conch processing plants and meetings with local fisherman and fisheries officials may engender discussions of catch restrictions and fishing controls.

During lobster season, individual local divers have caught more than 1,000 pounds of lobster in a single day, diving without the use of SCUBA. Developing sustainable fisheries is an immediate concern for this fishing community.

SOUTH CAICOS ISLAND MARINE PARKS MANAGEMENT

Course Dates:

Session I: June 13 - July 12
Session II: July 19 - August 17

Departure Point:

South Caicos Island, BWI

Course Number: EE (NS) 351

Case Study Question:

What management strategies will sustain the park ecosystems of South Caicos?

Field Work Focus

- ♦ Investigating habitat preferences and stock levels of major commercial shellfish species.
- ♦ Determining the health of coral reef systems.
- ♦ Assessing biodiversity in the Caicos national parks for comparison with habitats outside the park system.
- ♦ Evaluating the potential environmental and social impact of planned construction and development.

Course Objectives

The TCI are coral reefs which have emerged from the sea over long periods of alternate rising and falling of sea level. Coral reef systems provide excellent habitats for lobster and fish, while the shallow banks are sources of conch.

The reefs also attract tourists, a great source of potential revenue. Today these reefs are under assault from many sources including the physical removal of coral, dive operation damages, high sedimentation rates, eutrophication, and over-fishing of key organisms.

The establishment of parks can save some of these delicate ecosystems, but would force traditional fisheries to look for other "unprotected sites," simply moving the problem. Our focus will be on identifying natural resources, assessing their present exploitation and discussing management strategies to successfully set up marine parks. Faculty lectures on marine ecology, vertebrate and invertebrate zoology, coastal zone management and coral reef function will provide a framework for our field work. We will catalog resources within and outside of the park, using snorkeling or SCUBA diving and becoming familiar with the use of transects, techniques of population sampling, and statistical analysis. Field projects may be marine or terrestrially based and may involve environmental impact assessment, marine park design, working with local agencies, schools, or fisherman. Because everyone in the water must have a buddy and a staff member present, we will need to coordinate our projects and share data collection.

Note: If you intend to use SCUBA you must be certified before arrival; divers and snorkelers must bring their own equipment; weights and tanks may be rented on site.



Photo: Bruce Neal

Upcoming decisions regarding resource development here will influence the fate of one of the most beautiful and unspoiled coastal ecosystems in the Caribbean.

We will also consider the fin fishery, currently a less developed subsistence industry, which may increase in influence if tourists demand it and shellfish stocks continue to decline. In order to plan for its possible role in the future of South Caicos, we must understand the potential and long and short-term benefits of intensified use of the fin fishery. Using computer simulations, we can predict outcomes and yields of various fishing decisions. Pricing, methods of payment, local consumption, export practices, and international competition for market share will be examined. Our recommendations will consider the social costs of both over-fishing and planned restrictions.

Case Study #3:

Tourism: Economic salvation or environmental disaster?

Tourism is a rapidly expanding sector of the Turks and Caicos economy and much of the hope for future employment depends on its success. We will explore ways, such as developing an underwater nature interpretive trail, in which the Park can be managed to support tourism while minimizing negative environmental impacts. Hosting a mock tourist development conference with members of the tourist board and local entrepreneurs will enable us to examine the costs and benefits of increasing tourism and to explore ways in which small-scale ecotourism can be designed to involve and benefit the local community.

CENTER FOR COASTAL STUDIES

CENTER PROGRAMS

Coastal Rainforests and Marine Resources

Semester Program — Page 20

Conserving Marine Resources and Coastal Rainforests

Summer Course — Page 21

Center Objective

To study issues related to the restoration of degraded timberlands, watersheds, and fisheries in order provide recommendations that may lead to: building a sustainable fisheries system; promoting the conservation of threatened species; creating a sustainable timber industry; and developing a local ecotourism industry.

Critical Environmental Issues

The future of this entire area is being hotly debated, from logging camps and the homes of native peoples to the seats of the provincial and national governments. The provincial economy is currently heavily dependent on logging and related industries. As a result, the irreplaceable coastal rainforests here (*containing some of the largest and oldest trees in the world*) are being cut at an annual rate reported to be twice that of the Brazilian rainforest; almost a quarter of the region has already been denuded.

Clear-cut logging is also altering the critical flow of water from the coastal watershed to the estuaries and ocean, threatening migrating birds, fish and marine mammals in this unique marine ecosystem. There is a great need for ecological information and management recommendations during this critical period when future rates of logging are determined. If we are to help find new ways to support economic development of this coastal and old growth forest region while preserving its natural and cultural heritage we must address issues including:

- ◆ How do old growth forest and near shore marine ecosystems interact and how can their diversity and productivity be maintained?
- ◆ What alternative uses of the rainforest and coastal areas might be ecologically and economically viable (e.g. *ecotourism, fish hatcheries*)?
- ◆ Where do logging, fishing, native peoples' and environmental interests overlap?
- ◆ What areas of Clayoquot Sound should be fully protected as wilderness, partially protected/partially developed and fully developed?
- ◆ What is the current level of species extinction in the Clayoquot Sound region? What are the critical resources here? What is the role of large fauna (e.g. *black bears, cougars, killer whales*)?

Center Clients/Partners

We plan to work with non-governmental organizations, the provincial government and local groups (*including loggers, fisherman, artisans and other residents*), to help find new ways to support sustainable development of this coastal and old growth forest region while preserving its natural and cultural heritage.

Resident Faculty: Jeffrey Hyman, Ph.D., University of Tennessee (*Ecology*).

As this catalogue goes to press, we are in the process of hiring additional faculty for this new center.



Site Description

The Clayoquot Sound region of Vancouver Island, British Columbia, is where much of the world's remaining temperate rainforest meets bountiful Pacific waters. This area of rugged beauty in Canada's Pacific Northwest encompasses coastal rainforests and marine ecosystems that are considered to be among the richest and rarest in the world. Here, in one of the few wilderness areas left in North America, three of Vancouver's five remaining large unlogged coastal watersheds flow into the Clayoquot Sound. These watersheds



Photo: © Adrian Dorst

Tla-o-qui-ahs paddling a canoe on Meares Island where relics of winter camps of First Nation (Native Indian) groups, dating back over 4,000 years, have been found. As outstanding land claims are settled here, First Nation groups are likely to play a key role in determining the future of Clayoquot Sound's valuable coastal rainforests.

comprise over a half million acres claimed to be worth literally billions of dollars in timber resources.

For much of the year, the Tofino area where we will be based is home to small communities of both native and non-native people totaling about 2,000 people. During the summer months however, nearly 750,000 visitors flock to the area to take in the region's spectacular natural resources including those found in the neighboring Pacific Rim National Park.

Awe-inspiring old growth forests of towering cedar, Sitka spruce and Douglas fir trees are home to countless species of

Center for Coastal Studies



Photo: © Adrian Dorst

wildlife ranging from small forest mammals to bald eagles to wolves and black bears. The coastal marine zone supports unusually abundant fish and seabird populations as well as marine mammals including killer whales, porpoises and sea lions. The estuaries lying between these ancient forests and the sea support extensive shellfish beds, migrating waterfowl, and vital nursing grounds for fish including one of the world's largest salmon fisheries.

Hundreds of thousands of tourists come to Clayoquot Sound each year to take in the fishing, marine mammals, and spectacular coastal and forest vistas. This seemingly idyllic region has recently been at the center of one of Canada's hottest controversies. While the provincial economy is heavily dependent upon timber, many people believe Clayoquot Sound is the place where British Columbia should draw the line on clear-cutting forests.



Photo: Paul Willis

Center Facilities

Our Center is based in a cluster of wood and concrete buildings in a private cove overlooking Clayoquot Sound. Two to six students share each dorm unit which includes a bedroom, kitchen and bath; some units include wood-burning stoves. Faculty live in adjacent buildings. Although we are only a quarter mile from downtown Tofino, our views are of dense vegetation, a secluded beach and Pacific waters, fostering a sense of privacy and isolation. Classes are held in an adjacent building, which overlooks Duffin Cove, and also houses our library and computer center.

Canada's Pacific Northwest is losing its virgin rainforest at an annual rate that is two to three times faster than Brazil. A recent provincial government decision opens 74% of British Columbia's remaining temperate coastal rainforest to logging.

Living and Working Conditions

The small coastal town of Tofino lies at the end of a peninsula and is surrounded by Clayoquot Sound on two sides and Pacific Rim National Park on the third. In addition to numerous hotel and restaurant facilities, the town offers a small hospital, a post office, a bank, several small stores including a book-store and a hardware store, a school and a library. Access to the town is via one road, by boat or by small plane. We buy food locally - the same basics of meat, dairy, fruit and vegetables as we are used to in the U.S. plus fresh fish - and we do the cooking and clean-up. Time is set aside for recycling and participation in weekly Center maintenance.

This region boasts literally the mildest climate in Canada - one can work in shirtsleeves at times in the spring when

temperatures average in the low 50's; summer temperatures average 68°F. It rarely snows on the coast but, this is a rainforest, with several hundred inches of rain per year! Sunny spring and summer days will find us in tee-shirts but sturdy foul weather gear is also a must year-round. The weather and tides will no doubt drive our lecture and field work schedule that will include both terrestrial and marine-based surveys as well as interviews with government officials, First Nation members and representatives from local industries including logging and the fisheries.

Getting around in the dense green forests can be difficult. Curtains of ferns filter the few rays of sunlight that penetrate the evergreen canopy; moss carpets massive rocks and trees while countless species of wildlife find shelter in the jumble of ferns and bushes. Travel is often easiest along stream beds where eagles soar overhead in search of salmon and trout. Small and large boats will facilitate our water-based research activities along the rocky coasts.

Continued Next Page



Photo: Kathie Gow

The lessons we learn working with a leading developed country as it attempts to solve these economic and environmental dilemma can be applicable to situations you may encounter in a future career as an environmental professional in the U.S. or used as a model in developing countries facing similar challenges.

VANCOUVER ISLAND

COASTAL RAINFORESTS
AND MARINE RESOURCES**Program Dates:**

September 9 - December 12, 1995
February 1 - May 7, 1996

Departure Point:

Vancouver Island, British Columbia

**Students will be registered
in four academic courses:**

- BI/EE (NS) 379 Coastal Ecology
EE (NS) 374 Principles of
Resource Management
EE (SS) 303 Economic and Ethical
Issues in Sustainable
Development
EE 491 or 492 Directed Research

Please see pages 34-35 for course descriptions

Introduction

Coasts have provided a wealth of resources for humankind for thousands of years; it is no accident that a majority of great civilizations and cities have been established in coastal regions. The Clayoquot Sound region provides a perfect laboratory for exploring the relationship between ecosystems and the economy. The coastal and rainforest systems here support fish, shellfish, marine mammals, shorebirds, agriculture, aquaculture, forestry, tourism, recreation and transportation.

Excessive logging threatens both the quality and quantity of fresh water flow. Recent studies, for example, have found extensive damage to salmon spawning streams from clearcutting. As fish catches diminish and the future of logging is debated, the region's small communities are struggling with potential changes in their way of life. While immediate job loss is of deep concern, destruction of the productive capacities of the ecosystems upon which their livelihood depends is a greater threat. Over the past ten years, controversial land-use decisions for this area have further polarized not only the communities of Clayoquot Sound, but people across Canada and around the world.



Photo: © Adrian Dorst

One of North America's last wilderness areas, Canada's Pacific Northwest is home to countless species of wildlife including this black-tailed deer.

We begin the semester with two weeks of orientation and preliminary lectures plus a week-long introduction to research techniques, statistics and scientific writing before moving into the three case studies and directed research projects.

Case Study #1:

Can ecosystem management of forests maintain a healthy ecosystem as well as support the local, regional, national, and international logging economy?

"Ecosystem planning or management", incorporating issues of sustainability, landscape ecology, temporal and spatial scale, biodiversity, uncertainty and adaptive management, conflict resolution, and institutional change, is gaining favor as a guide for natural resource use. Traditional approaches to resource management have not led to sustainable resource use because they generally fail to nurture the ecosystems and biodiversity or to provide economic gain. We will explore the timber industry, examining the ecological, social, and economic issues involved in ecosystem planning on Vancouver Island, analyzing land-use decisions and generating alternative plans

for ecosystem protection and sustainable resource use in Clayoquot Sound. Research may include mapping ecosystems, surveying and comparing forest structure and biota, documenting land-use approaches used by First Nations, analyzing alternative land use options, and assessing the economic and ecological potential for harvesting forest resources other than trees.

Case Study #2:

How can the coastal watershed be managed to support a healthy marine ecosystem as well as viable fisheries?

The near-shore area of Clayoquot Sound supports important shellfish fisheries and serves as a nursery ground for fish that spend their adult lives in the ocean. There is concern that the salmon and shellfish fisheries here are declining. Restoration of healthy fisheries involves marine and watershed habitat protection and enhancement, as well as changes in harvest pressure. The international dilemma of managing a common fisheries resource will be explored in depth. Working on the docks or from boats, we will focus on the physical, chemical, and



Photo: © Robin Baird



Clear-cut logging is altering the critical flow of water from the coastal watershed to the estuaries and ocean, threatening migrating birds, fish and marine mammals in this unique marine ecosystem.

VANCOUVER ISLAND

CONSERVING MARINE RESOURCES AND COASTAL RAINFORESTS

Course Dates:
Session I: June 13 - July 12
Session II: July 19 - August 17

Departure Point:
Vancouver Island, British Columbia

Course Number: BI/EE (NS) 353

Case Study Question:

How can the coastal watershed be managed to support a healthy marine ecosystem as well as viable fisheries?

Field Work Focus

- ◆ Identifying and analyzing alternatives to current unsustainable land-use practices.
- ◆ Evaluating reforestation methods for stabilizing soils and restoring wildlife habitat.
- ◆ Investigating watershed and forest management options that preserve key marine resources.
- ◆ Examining the economic and ethical considerations regarding land-use alternatives.

Course Objectives

Research has indicated that logging can have detrimental effects on streams, impacting the spawning of adult fish and the rearing of juvenile fish. In addition, near-shore marine habitats, impor-

biological characteristics of stream and near-shore habitats, and potential impacts of watershed logging practices on salmon and shellfish populations. Potential projects include comparisons of plankton abundance across space and time, surveys of harvesters' attitudes toward management, and analysis of ways that individual harvesters can economically diversify and ride out fluctuations in catch quotas. Because research on the water in Clayoquot Sound is dependent on weather conditions, we will also provide several shore-based sociological and economic projects related to fisheries.

Case Study #3:

What alternative resource management and development strategies are sustainable for Clayoquot Sound?

Ecotourism is often offered as an alternative to extractive industries such as logging and fisheries. But tourism can bring its own set of problems. Land conversions and habitat loss, point-source and runoff pollution, noise pollution, and boat traffic can impact forest biota, salmon nurseries, shellfish, shore birds, ecosystems, and the quality of the recreational experience in Clayoquot Sound. The development of tourism here is still in a stage when severe impacts to the ecology and social fabric of the area can be avoided — but will they be? We will consider how to develop tourism in an ecologically and socially responsible manner. Potential research topics include: overlay mapping and identification of sensitive areas; ways to develop ecotourism; how to channel recreational activities in space and time to avoid environmental and social impacts; prediction of interactions between people and animals such as bears; regulation of sport fisheries; local attitudes toward tourists and tourism; and park and trail planning.



Photo: © Garth Lenz

The coastal rainforests here contain some of the oldest and largest trees in the world. A single old growth cedar tree, 300 feet tall and 18 feet in diameter, can bring \$30,000 at the lumberyard.

tant for salmon and shellfish, can also be impacted by logging in watershed forests because the health of these habitats is influenced by the quantity and quality of the water and materials delivered by the streams. There is concern that the salmon and shellfish fisheries of Clayoquot Sound are on a downward trend and groups, including the First Nations, are calling for studies on alternatives to current harvesting methods.

We will focus on stream and near-shore habitats, and analyze potential impacts of logging practices on salmon and shellfish populations. Lectures will introduce stream ecology, biotic integrity, nutrient cycles and energy flow and coastal zone management in preparation for our field work. Directed projects may focus on the ecological functions of coarse, woody debris in near-shore habitats; comparisons of stream characteristics and biota in old-growth, second-growth, and recently cut stands; stream restoration methods; costs of restoration vs. the costs of conservation; and an economic and ecological analysis of alternative logging methods. Assessments of salmon and shellfish abundance and plankton density would contribute to a long-term data base on stock and productivity trends. Research may be conducted from docks where catches are brought in or from power boats. Our efforts are intended to support the creation of a resource management plan that encourages sustainable economic development while preserving natural resources.

PALAU

CENTER FOR
ISLAND MANAGEMENT STUDIES

CENTER PROGRAMS

Island Management Studies

Semester Program — Page 24

Management of Tropical Island Resources

Summer Course — Page 25

Center Objective

To study issues related to managing impacts of economic development on the terrestrial and marine environments of a small island nation to help ensure the equitable distribution of economic benefits to Palauans while conserving natural resources for the use of future generations.

Critical Environmental Issues

The possible negative ecological effects of development are magnified in island communities because of limited availability of resources (*food, water, forests and fuel*) and options for waste disposal. The introduction of outside resources (*finances, labor, introduced species and technologies*) has economic, social, political and ecological implications. Studying the unique aspects of islands not only enables us to contribute to their preservation, appreciating their differences helps us understand mainland environmental issues as well.

Palauans view the imminent development facing their newly independent nation with hope and fear as they look to neighboring islands and see development run amok – dominated by foreign interests which have degraded the environment, brought in foreign workers, and left only menial tasks to the original residents. Our role in this process will be to support the planning efforts of the Palauan people by answering the following:

- ◆ What are the unique natural resources, both terrestrial and marine?
- ◆ What are the likely environmental and social impacts of development and how can they be optimized?
- ◆ Which technologies for electricity, water, sewerage, and transportation are most appropriate for this isolated area?
- ◆ In addition to tourism, what resources such as fishing, agriculture, crafts, and light industry can be sustainably developed?

Center Clients/Partners

The government of Ngaraard State has offered to help SFS develop a site in exchange for our professional cooperation in the planning process. We will work with the 16-member State Planning Commission as well as the national marine resources, forestry and agricultural agencies. Local fishermen/women and farmers are additional clients for our work.

Field Director: Joel Miles, Ph.D., University of Hawaii (*Horticulture*)

Resident Faculty: John Wingard, Ph.D., Pennsylvania State University (*Anthropology*)
Jennifer Snyder, M.A., University of Oregon (*Urban and Regional Planning*).



Site Description

The island nation of Palau lies at the western edge of the Micronesian archipelago in the far western Pacific; Guam is 700 miles to the north and the Philippines about 500 miles to the west. The Republic of Palau consists of 200 islands stretching over 400 miles, but only eight are inhabited.

The sixteen States of Palau are based on ancient tribal territories and led by Tribal Chiefs. The nation's capital is Koror, connected to the island of Babeldaob and the international airport



Photo: Bruce Nail

We will explore Palau's renowned reefs and shallow waters with snorkeling gear. These ecosystems are an ever-increasing draw for tourists and will require thoughtful management plans to insure their protection.

by a bridge. Babeldaob, the largest island, is densely covered by lush tropical forests in the uplands, with mangroves, beaches, and isolated hamlets along the coasts. There is no system of roads, electricity, or telephones linking these hamlets, so communication is intermittent and largely by small boat.

The natural resources here are nothing short of spectacular. Verdant forests provide a haven for colorful native birds, wildlife, and endemic plant species. An offshore reef harboring more than 625 species of coral and over 1,400 species of fish offers protection from ocean tides,

Center for Island Management Studies



Photo: Joel Miles

Palauan waters are home to over 1,000 species of fish, more than 625 species of corals and anemones, and 7 of the 8 known giant clam species. Issues affecting marine resource management here include changes in fishing methods and technology and increasing demand for fish for internal use and export.



Photo: Joel Miles

Palau is known for its Rock Islands, a grouping of very small islands whose vertical rock walls are undercut at sea level and topped by lush greenery, giving them the appearance of giant green mushrooms.

leaving a turquoise lagoon that rings the entire island. These clear, shallow waters afford opportunities for subsistence fishing and spectacular snorkeling. Estuarine crocodiles and dugong are rarely seen, but sea turtles can be spotted regularly.

Center Facilities

Our Center is located in a school in the small village of Ulimang, along the east coast of Ngaraard State on the island of Babeldaob. This site has the greatest expanse of beaches in the country and spectacular hillside vistas. The road which will link all the States of Babeldaob is planned to go through Ulimang, bringing many changes in the next few years. Students will live in dormitories, one large room for men, one for women. Toilet facilities are in a building a short walk from the dorms. Classes are held in the school building which also houses a computer room, library and cafeteria.

Living and Working Conditions

Our lecture and field work schedules will often be driven by weather and tides. Activities include long walks to work on resource inventories, near shore swims to study the fringing reefs, and interviews with local residents and officials. Most Palauans speak English,



Photo: Bob Singer

Despite the apparent tranquility of our island setting, a sense of urgency permeates our first semesters here as decisions made in the next few years will irrevocably impact this unique nation.

which is taught in the schools and some residents also speak Japanese. Students will be instructed in a few conversational phrases in Belauan, the local language.

Our presence in this small village of 50 families will hardly go unnoticed and we will have many opportunities to interact with the local community. The village has about 30 homes, an elementary and a girl's high school, a church, and a bai (meeting house). The one small store is stocked with canned goods. Local people fish or work for the schools or government; many women tend taro patches. Generators provide electricity every evening until midnight. As the government has one emergency telephone via microwave link to Korror and there is no radio reception, we will need to be quite self-reliant as a group.

Our meals are eaten in a cafeteria, staffed by a local cook. As one small refrigerator is the only means to keep food fresh, we either eat fresh fish or canned meats, with taro, rice and canned vegetables and fruits between weekly supply trips.

The climate here is truly tropical as the heat is moderated by the 80°F ocean. Daytime temperatures range from 80° to 90°F and cool slightly at night. Annual rainfall is about 150 inches, falling mostly in heavy showers at night, but sometimes lasting for a couple of days at a time. A steady breeze usually blows onto the beach, keeping the near-shore sites like ours relatively cool.

Continued Next Page

P A L A U

ISLAND MANAGEMENT STUDIES

Program Dates:

September 9 - December 12, 1995

February 1 - May 7, 1996

Departure Point:

Korror, Palau

Students will be registered in four academic courses:

- EE (NS) 377 Tropical Ecology and Sustainable Development
- EE (NS) 374 Principles of Resource Management
- EE (SS) 302 Environmental Policy and Socioeconomic Values
- EE 491 or 492 Directed Research

*Please see pages 34-35 for course descriptions***Introduction**

An election in 1993 paved the way for Palauan independence by approving the Compact of Free Association, obligating the U.S. to support the development of infrastructure — roads, power, water, plumbing, and communications — which will leave the new nation capable of creating a self-sufficient economy. Since the Japanese left here nearly 50 years ago, the 14,000 Palauans have lived in a welfare economy administered by the U.S.

Palau's President has mandated that economic development be based on a three-part foundation: tourism, agriculture, and marine resources. He has made it clear that economic success requires a clean environment, carefully managed for long term sustainability. Our goal is to let Palauans make their own choices while providing them with the information they need to preserve the natural riches of the islands and surrounding waters.

We begin the semester with two weeks of orientation and preliminary lectures plus a week-long introduction to research techniques, statistics and scientific writing before moving into the three case studies and directed research projects.

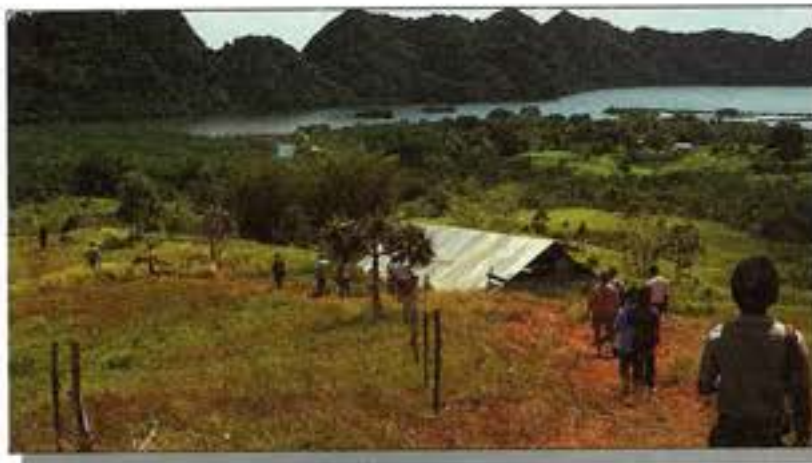


Photo: Joel Miles

Case Study #1:

Is tourism, in comparison with other economic development options, a viable alternative for the economic development of Ngaraard State?

Tourism has great potential for producing income and sources of employment for Palauans yet large numbers of tourists could have negative impacts on the terrestrial and marine environments. The government has expressed interest in "ecotourism" as an alternative to the mass tourism which has heavily impacted the societies and environments of other Pacific islands. There is no evidence, however, that ecotourism can make the anticipated economic contributions, nor is there clear information on the impacts even small-scale tourism can have on small villages such as the one where we are based. Other issues we will address include the effects of tourism on society including the introduction of foreign labor into a small community. More information is also needed on other development options such as small industries, agriculture, and fisheries.

"Learning in the field was so different from classroom learning that I didn't realize how much of the environment I had soaked in. As we became immersed in our case studies, I found myself so interested in the different topics that the hard work I ended up doing came almost naturally."

Amy O'Neal, West Hartford, CT - Smith College

Case Study #2:

How can the marine resources of Ngaraard State be managed in a sustainable manner?

Potentially useful marine resources include the fin fish and shellfish fisheries, marinas, boat building and repair. Palauan society has a very powerful conservation and management ethic, particularly with regard to marine resources. Effective resource management practices, developed over thousands of years, now need to be documented and, in many cases, adapted to changes in economic conditions. We will assess the current status of various marine resources, investigate current utilization patterns, and evaluate options for managing these resources to strengthen the economy. Areas we will address include changes in fishing methods and technology; increasing demand for fish (both internally and for export); important species such as giant clams and trochus; mariculture/aquaculture; tension between tourists and fishermen; and



Photo: Joel Miles



P A L A U

MANAGEMENT OF TROPICAL ISLAND RESOURCES

As there is no system of roads linking villages, much of our travel and field work will be undertaken in small boats and our daily schedules will often be driven by weather and tides.

gender roles in marine resource management. We will work closely with the state government, the national marine resources agency, non-governmental organizations, and local fishermen/women to develop plans for sustainable management of marine resources.

Case Study #3:

How can farmers in Ngaraard State increase productivity and profitability in harmony with the environment and society?

A growing population and increasing tourism are resulting in an increased domestic demand for agricultural products, especially flowers, fruits, and vegetables. There are also potential export markets in Guam, Saipan, and Japan, but work is needed to develop and supply them. Taro is the most important crop in Palau; women's lives have revolved around the production of taro which is very labor-intensive and is no longer sufficiently remunerative. Using the Rapid Rural Assessment method, students will work as interdisciplinary teams assessing the farm system. Concepts we will apply include importation of food; import substitution; evaluation of soil and other resources; current farming practices and alternatives; agroforestry; integrated pest management; water pollution; profitability; and labor inputs.

Note: Palau is renowned for its reefs, which we will explore from shore with snorkeling gear. Interested and qualified students may wish to set aside time and money to SCUBA dive with commercial dive operators during the four-day mid-term break or at the end of the semester.



Field work will take place in both terrestrial and marine habitats. Our goal is provide needed information so that Palauans can make their own choices regarding the preservation of the natural riches of this tropical island paradise.

Photo: Bill McCormick

Program Dates:
June 20 - August 17

Departure Point:
Korror, Palau

Course Number:

EE (NS) 354 Management of Tropical Island Resources

EE 491 Directed Research

(Note: This 8 week course carries 8 semester credits).

Case Study Question:

How can farmers in Ngaraard State increase productivity and profitability in harmony with the environment and society?

Field Work Focus

We will begin by asking our hosts to assess their information needs; we are likely to assume such tasks as:

- ◆ Determining which watersheds must be preserved to assure sustainable agricultural development, clean water, and control of sedimentation.
- ◆ Evaluating where roads should be routed to minimize impacts.
- ◆ Identifying special resources, including nesting sites, endangered species, and historic cultural sites.
- ◆ Assessing which crops best suited for harvest.

Course Objectives

Agriculture is the third, and most neglected, of the three components of Palau's economy identified for emphasis by the national government. A growing population and increasing tourism are resulting in an increased domestic demand for agricultural products, especially flowers, fruits, and vegetables. Three-fourths of Palau's land mass is forested, and development plans call for it to remain as forest for protection of watersheds. Much of the remaining land is suitable for agricultural production, but with many constraints due to steep slopes, low fertility, and other factors. Traditional agricultural practices are ecologically sound, but at the same time, are very labor-intensive and Palau's small labor force, along with the attraction of higher income employment alternatives, have led to a decline in agricultural production.

Lectures introducing the natural history and culture of Palau, principles of resource economics, symbiosis, competition and nutrient and energy flow in tropical ecosystems provide a background for our field work. We will investigate traditional and alternative land-use practices, integrated pest management systems, agroforestry options and the impacts of resource use patterns on the coastal ecosystem. Interdisciplinary teams will utilize several land-use classification systems and procedures to assess impacts on resources. Using our own demonstration plots, we will work with villagers to develop management plans based on ecological and economic principles and cultural needs.

COSTA RICA

CENTER FOR
SUSTAINABLE DEVELOPMENT STUDIES

CENTER PROGRAMS

Studies in Sustainable Development

*Semester Program — Page 28*Alternative Strategies for
Preserving Tropical Ecosystems*Summer Course — Page 29*

Center Objective

To develop sustainable management models for Costa Rica's abundant but threatened natural resources using small communities as the operational unit and honoring the social, cultural and economic development needs of local residents.

Critical Environmental Issues

Costa Rica faces the challenge of protecting endangered ecosystems which are both environmentally and economically valuable without the option of placing additional land under federal protection; most of the land that can be preserved legally, more than one-fourth of the entire country, already has been so designated. Yet the need for productive agricultural land is escalating, and unsustainable practices outside of conservation areas threaten their longterm survival. Both traditional and alternative land-use options pose potential natural resource deterioration including water quality, soil erosion and pesticide build-up. To identify sustainable development options for the local community, we must answer such questions as:

- ❖ Can we use nature as a model for the design of new tropical agroecosystems?
- ❖ How can people and forests interact more effectively?
- ❖ What are the sociopolitical and economic factors affecting agricultural practices in Costa Rica?
- ❖ Is ecotourism a sustainable option for communities?
- ❖ What is the role of grassroots entrepreneurship in sustainable development?

Center Clients/Partners

A number of private organizations and government agencies look forward to sharing our research results, from Costa Rica's National Park Service and its central tourist authority to the Costa Rican Institute for Electricity to privately held preserves, the Forest Service, and the small cooperatives organized by farmers.

Field Director: Liana Babbar, Ph.D., University of Michigan (*Natural Resources*).

Resident Faculty: Bernardo Aguilar, M.S., University of Georgia
(*Agricultural and Applied Economics*).

Jose Luiz Diaz, M.A., Vanderbilt University

(*Economic Development and Social Planning*).

Lisa Bradshaw, Ph.D., University of California at Davis (*Ecology*).

The SFS Center for Sustainable Development Studies is the result of a cooperative effort between SFS and a consortium of schools including the University of Michigan, and Allegheny, Colby, Dickinson and Middlebury Colleges. A portion of the spaces in each semester are reserved for students from Consortium schools. Please see page 37 for details.



Site Description

Two of Costa Rica's four borders are beaches; the Pacific lies to the west and the warmer, calmer Caribbean to the east. Similar in size to West Virginia, the country seems to tilt toward the Pacific; the sloping, hilly emerald terrain is sharply cut by swift rivers. More than half the population lives in the Central Valley, home to both the capital, San Jose, and Atenas, the 17,000-person county where our center is found.



Photo: Ed Stashko

Our Center in Barrio Los Angeles lies in the heart of Costa Rica's fertile Central Valley.

Costa Rica's natural resources have made it a prime destination for ecotourists and with good reason. Its cloud forests, rainforests and mountain plains shelter more than 6,000 plant species (including more than 1,000 orchid varieties). Costa Rica's butterflies are so famous that "butterfly ranching" has emerged as an economic sector; over 500 species are found here. More than 800 bird species – quetzals, toucans, hummingbirds, scarlet macaws – are found in the wet and dry forests. And the magnificent beaches are among the world's largest-known nesting grounds for sea turtles.

Center for Sustainable Development Studies



Photo: Chris Vaughan

SFS student planting seedlings with local residents to help stem erosion. The fact that Costa Ricans are addressing their environmental problems with creativity and commitment may ensure the availability of critical resources for the next generation.

Photo: Moises Leon



SFS students picking coffee: "I now recognize that there are many sides to an issue to be taken into account before reaching a solution. I also know that education and opportunities like I had in Costa Rica are ways to bridge the gap between thinking about solutions and taking action."

Tina Van Meter,
Keego Harbor, MI
University of Michigan

Farms producing mangoes, oranges, lemons, avocados and papayas lie on all sides below our small farm on the crest of a hill above Costa Rica's Rio Grande. Not far away, four rivers run to meet it; significant patches of forest lie along their banks.

Local farmers, many working properties from 1-10 hectares in size, also grow vegetables, coffee, and sugar cane, and raise cattle. In the past three years, their concern for the future of their area has led them to replant more than 100 hectares with trees, and to organize into groups whose goal is ecosystem restoration.

Center Facilities

The Center for Sustainable Development Studies is in Barrio Los Angeles, a small town on the outskirts of Atenas. The main property includes a large house where faculty live and meals are eaten. Students live in a refurbished chalk factory that has been converted to dormitory space; there are five large bedrooms (6-7 students to a room), two bathrooms, classrooms, a small laboratory, and a library/computer room.

Cooking is shared between students and a local cook. Meals are a feast for vegetarians and adventurous souls

excited by ethnic cuisine: rice, beans, vegetables, plantains, and abundant, locally grown tropical fruit. For variety, locally raised meat and poultry is sometimes available.

Living and Working Conditions

During the first half of the program, our days at the Center start with lectures and field work; an important feature in the early part of the program is Spanish lessons aimed at easing communication with local residents. We will take numerous field trips, some short hops within the Central Valley, some to public and private preserves a distance away. Evenings are reserved for guest lectures and presentations from local experts, but we do slot in time for relaxation and group sports.

Because the population's land-use choices are among our chief concerns, we will spend sizable blocks of time on local farms and speaking with agricultural cooperatives. Community involvement, which may extend to community service projects or volunteering, is an important feature of this program.

At 2,600 feet above sea level, nights are cool, days warm and possibly damp. During the course, we visit four other, very different regions: two areas of low-land tropical forest which include a rainforest and a dry-forest region where cattle-raising and ecotourism are key; a cloud forest and a coastal ecosystem.

Continued Next Page



Photo: Tracie Seder

Costa Rica has placed over a quarter of its land into preserved areas, yet rates of deforestation outside of these preserves are among the highest in the world.

C O S T A R I C A

STUDIES IN SUSTAINABLE DEVELOPMENT

Program Dates:

September 9 - December 12, 1995

February 1 - May 7, 1996

Departure Point:

San Jose, Costa Rica

Students will be registered in four academic courses:

- EE (NS) 374 Tropical Ecology and Sustainable Development
- EE (SS) 371 Sociopolitical Systems and Sustainable Development
- EE (SS) 303 Economic and Ethical Issues and Sustainable Development
- EE 491 or 492 Directed Research

*Please see pages 34-35 for course descriptions***Introduction**

Costa Rica faces a struggle common to many developing countries: How to preserve its beautiful (and increasingly economically valuable) natural resources while fostering its population's desire for First World-style prosperity. The struggle is vividly evident in its land protection efforts: It has placed 27% of its land mass into preserved areas, yet at the same time suffers some of the world's highest rates of deforestation in unprotected lands just beyond the parks' borders.

Concern is growing that some of the abundant but separate preserved patches are too small to provide longterm wildlife habitat; at the same time, agricultural practices threaten the environment while the economic and cultural need for agriculture continues. And, although Costa Rica's remaining natural riches have attracted international attention, there is no concrete evidence that ecotourism is a sustainable solution to the economic dilemma. The development which follows on its heels may be as destructive as agriculture has been to date.

We begin the semester with a module introducing the problem-oriented case study approach, as well as Spanish-language lessons and lectures on the history, economics, culture and environment of Costa Rica before moving into the three case studies and pursuing directed research projects.



Photo: Liana Babbar

Case Study #1:

Do the current management and design of Costa Rica's protected areas effectively meet the goals and objectives of conservation?

Protected areas, ranging from a few to several hundred hectares, exist under both private and public ownership. The country's aggressive land-protection efforts and famous natural resources are a powerful magnet for tourism, which has just surpassed agriculture as Costa Rica's chief income source. No one knows whether tourism offers long-term economic viability; it may trigger negative social and cultural impacts, and further strain forest fragments. In addition, many protected areas do not provide sufficient habitat to protect some wildlife. During field trips to national



Photo: Chris Vaughan

We will spend approximately a third of our time on off-site field trips. Our case study on Sustainable Entrepreneurial Models will include a visit to examine an experimental mangrove charcoal business.

parks, biological reserves, forest reserves, and private protected areas, we will quantify the extent to which actual management approximates stated reserve objectives and meets the requirements of key species for regeneration and maintenance within a community. Using this information, combined with an understanding of the pressures on protected areas, we can evaluate whether there is a need to explore conservation alternatives.

Case Study #2:

How can agroecosystems promote sustainable management in Costa Rica's protected zones?

Despite its decision to place more than one-fourth of its land mass into protected areas, Costa Rica has one of the world's highest rates of deforestation. Because agriculture still represents one of the country's main sources of income, needs for productive land have overridden interest in forest preservation. As Costa Rica becomes more involved in the international market, important changes are occurring in the agricultural sector. New policies regarding agricultural practices (e.g. agroforestry, pesticide use), commercial relations (e.g. marketing and credit), and socio-political aspects (e.g. labor conditions) threaten the sustainability of farming systems. Using biometrics and field techniques such as measuring and censusing, we can assess local land-use choices and alternatives to



"When we first arrived, I bombarded my professors with questions such as 'should we boycott coffee and bananas to save tropical ecology or buy them en masse to support sustainable agriculture? One faculty simply smiled and said I should try to answer those questions for myself over the next three months.'"

Fred Werner, Chevy Chase, MD -
University of Michigan

conventional agricultural practices. Field trips to rainforest reserves and to coffee and organic farms can help us determine whether nature can be used as a model for local agriculture.

Case Study #3:

What are the impacts of foreign direct investment and sustainable entrepreneurial models?

Development in a Third World country most often comes at the price of involvement by industrialized nations, usually by the those countries in which the interested multinational corporations have their bases. These interests in Central America are most often fruit-producing concerns which, like their parent companies, are profit-driven. Such operations compete with local traditional and grassroots businesses for land, capital and labor. Since they are not locally based, they tend to show less concern than indigenous businesses for the health of local ecosystems. On the other hand, traditional agricultural businesses may be sustainable, but have slender economic success. Our search for a sustainable and profitable alternative will take us from the cloud forest to the mangroves of the Pacific coast to study three agricultural-product businesses - blackberries, bananas and mangrove charcoal. Using field observations and interviews, we will focus on ecosystem stability as well as on the cultural and economic factors affecting success.

Prerequisites: This program is offered at the intermediate level. Applicants must have completed the following college level courses: ecology; environmental studies; international development and Spanish prior to participating.

COSTA RICA

ALTERNATIVE STRATEGIES FOR PRESERVING TROPICAL ECOSYSTEMS

Program Dates:

Session I: June 13 - July 12
Session II: July 19 - August 17

Departure Point:

San Jose, Costa Rica

Course Number:

EE (NS) 352

Case Study Question:

Do the current management and design of Costa Rica's protected areas effectively meet the goals and objectives of conservation?

Field Work Focus

- ❖ Determining how much habitat protection is supplied by currently protected areas.
- ❖ Investigating whether current regulations, protecting areas including buffer zones, create true protection or mere "paper parks."
- ❖ Determining whether private initiatives can preserve ecosystems as efficiently as protected areas.
- ❖ Investigating whether privately protected areas are economically viable.

Course Objectives

Encouraging protection strategies on private lands may hold the key to preserving wildlife populations both here and in other countries. This is

particularly true now, when tourism is about to become Costa Rica's No. 1 source of income. Success will require investigating both environmental and cultural impacts and identifying persuasive economic benefits that will result from sustainable use.

Our search to identify successful management strategies will take us to both officially protected and privately created preserves including parks, volcanoes, rainforests, cloud forests and wildlife preserves. Faculty lectures will address the history of Costa Rican national parks, models of natural resource protection, economics and sustainable development, and managing for diversity. Guest speakers will explain federal protection schemes and the operation of private reserves. During our visits we will conduct ecological inventories of protected areas, measure impacts on watersheds, and conduct community interviews with owners whose lands border the parks. Assessments of the economic and social impacts of preservation and degradation will be considered as we prepare to recommend the most viable preservation strategies.



Photo: Moises Leon

We will visit coffee, banana and pineapple producers. SFS students Stephanie Katz (Boston University) and Brian Silinski (Allegheny College), and faculty Bernardo Aguilar presented recommendations from their directed research project on coffee production at the 1994 International Conference on Ecological Economics.

AUSTRALIA

CENTER FOR RAINFOREST STUDIES

CENTER PROGRAMS

Tropical Rainforest Management

Semester Program — Page 32

Tropical Reforestation

Summer Course — Page 33

Center Objective

To develop scientifically sound, culturally acceptable and politically and economically feasible alternatives for the conservation and management of the unique Queensland rainforest.

Critical Environmental Issues

The need to balance ecology and economics is acutely felt in North Queensland, which hosts Australia's remaining tropical rainforests. While the forests now have protected status, the country still struggles with the conflict between resource use and preservation and the need to decide the fate of degraded lands. We will attempt to answer such questions as:

- ♦ What changes in wildlife laws, protected lands, zoning rules and land management practices would halt the slow demise of the cassowary locally?
- ♦ What combination of planting strategies and plot maintenance procedures yield the greatest reforestation success?
- ♦ Will forest corridors reduce the negative effects of habitat fragmentation and improve the longterm preservation of plants and animals?
- ♦ Are continued agricultural development and human settlement compatible with preservation and maintenance of biodiversity in Australian tropical rainforest regions?

Center Clients/Partners

We will share our data with the Commonwealth Science and Industrial Research Organization, the Wet Tropics Management Agency, and the Cairns and Far North Environmental Centre as well as with the Queensland National Parks and Queensland Forest Service. Local farmers, ranchers and foresters have a particular interest in our findings.

Field Director: Paul Robertson, Ph.D., University of Kansas (*Zoology*).

Resident Faculty: Tony Cummings, M.E.S., Yale University (*Environmental Studies*).

Amy Jansen, Ph.D., James Cook University (*Vertebrate Ecology*).

Bruce McNab, M.Sc., University of Alberta (*Natural Resource Economics*).



Site Description

The State of Queensland constitutes Australia's northeast corner; Tropical Far North Queensland hosts the greatest biological, climatic and social diversity in all Australia. Chief among its treasures: The country's only remaining rainforests, less than 1% of its land area, which lie cradled in a narrow, broken belt along the northeast coast.

Australia's dense and verdant rainforests are as rich and valuable as their better-known New World counterparts - in some respects, perhaps even more so.



Students and faculty have planted over 6,000 trees in deforested areas. Over 5,000 seedlings are now growing in our shade house; our goal is to plant 2,000 trees per year.

They are treasure houses of primitive flowering plants, species long since extinct on other continents but surviving here since the Mesozoic period. They shelter an astonishing array of bird species from the brilliant king parrot to the flightless, ostrich-like cassowary. And, they are home to a great range of marsupials such as possums, bandicoots, tree-kangaroos and gliders, evidence of an evolutionary pattern seen nowhere else in the world.

Center for Rainforest Studies

Photo: David Bathgate



Now that the area around our Center has been protected from further deforestation, we need to better understand the relatively new concept of reforestation. Students discuss results of tree planting efforts with a local forester.



The Center for Rainforest Studies, called "Warrawee" (you are welcome here) in the local Aboriginal language, is located amid 153 acres of rainforest and secondary growth forest.

Photo: David Wilson

Our Center for Rainforest Studies lies in the midst of this bounty: Of the property's 153 acres, approximately a third is mature rainforest, and another 50 are forest regrowth. The site - called "Warrawee," aboriginal for "You are welcome here" - lies in the northern foothills of the Atherton Tableland. Although remote (the nearest town is a 20 minute drive away), you will stop regretting the seclusion the first morning you wake to the birds' dawn chorus, or the first time a group of flying foxes sweeps overhead at dusk.

SFS gratefully acknowledges the Archer Daniels Midland Company, processors of agricultural products, for their support of this program.



Center Facilities

The field station lies at 800 meters elevation in the midst of a rolling, hilly property surrounded by protected World Heritage forests. Students live dorm-style in four newly constructed, eight-person cabins; faculty occupy an additional two cabins nearby. The main building has lecture, computer and library rooms, a collection of research equipment, a kitchen and washing machine; solar and standard electricity provide our power.

Living and Working Conditions

The sounds of scurrying wildlife and singing birds outside our rustic cabin windows provide a natural alarmclock. After breakfast on the patio of the main building, we're off to one of several morning lectures. Lunch will often be eaten in the field, where we spend most of the afternoon engaged in field work or visiting sites of interest. Returning to the Center by nightfall, we may have an opportunity to glimpse our resident platypuses before the darkening skies are dotted with flying foxes. Dinner may involve a culinary adventure to be shared with the group or with our neighbors at the regularly scheduled "barby" hosted by the Center.

Once we begin our directed research projects, lectures diminish and field work and data analysis increase. We will work in forest and modified habitats on the SFS property as well as in the adjoining protected forests and nearby private lands. The communities of the Atherton Tableland are small and residents get to know us quickly. As a result, volunteer opportunities - building trails, giving presentations at local high schools, meeting local conservation groups, and planting seedlings - are available.

We buy food locally - the same basics of meat, fish, dairy, fruit and vegetables as we are used to in the U.S. - and we do the cooking and clean-up. Students also organize recycling and composting and participate in weekly Center maintenance.

At 17 degrees south of the equator, the Atherton Tableland has two seasons: wet and hot, or cool and relatively dry. The Australian summer stretches from November to March, and can produce heavy rains and soggy roads; dry season arrives in April, along with night temperatures that can sink as low as freezing. Winter days are usually about 25 degrees C.

Continued Next Page

A U S T R A L I A

TROPICAL RAINFOREST MANAGEMENT

Program Dates:

September 9 - December 12, 1995

February 1 - May 7, 1996

Departure Point:

Cairns, Queensland, Australia

Students will be registered in four academic courses:

- BI/EE (NS) 369 Rainforest Ecology
- EE (NS) 370 Principles of Forest Management
- EE (SS) 302 Environmental Policy and Socioeconomic Values
- EE 491 or 492 Directed Research

Please see pages 34-35 for course descriptions

Introduction

The narrow belt of rainforest which borders the Queensland coast has suffered the same fate as most other rainforests; agriculture, ranching, mining and logging have destroyed and disrupted habitat. Australia, realizing that its forests shelter unique primitive plant species and birds and marsupials



Photo: David Bathgate

"When I saw the rainforest for the first time, I knew I had made the right decision in coming to Australia. At first it was overwhelming and the whole thing seemed like an ocean of green in which everything was the same. I soon learned the incredible diversity and complex interactions that occurred right before my eyes everyday."

Julie Iannini, Allentown, PA
Tufts University



Photo: Ed Stashko

Awakened by the "dawn chorus" of rainforest birds, students set out on an early morning birdwalk with faculty member, Amy Jansen

Case Study #1:

What are the most viable reforestation strategies for the Atherton Tableland?

Rainforest areas protected by the Australian government may be too small, fragmented, or vulnerable to human activities to provide for the longterm viability of some plant and animal populations. Restoration of degraded areas which were cleared for farming may ease the problem, particularly in creating wildlife

corridors to reduce fragmentation and extinction effects. Yet the success rates of different reforestation strategies, e.g. natural regrowth, low diversity plantings, and high diversity plantings, is unknown. Through field trips to natural areas and areas reforested in a variety of ways, we will seek to understand the role that reforestation can play in restoration, wildlife conservation and watershed protection. We will hear lectures from forestry professionals and grassroots reforesters; study and compare a variety of experimental plantings; and help to design experimental plots for longterm monitoring.

Case Study #2:

What is the best set of policies for conserving and managing cassowaries on the Atherton Tableland?

The majestic flightless cassowary, a rare inhabitant of our surrounding forests, is the touchstone for conservation efforts in North Queensland. Though treasured, the bird is in slow but steady decline. A severe lack of data on its range, habitat needs, food sources, density and distribution have frustrated conservation



Photo: Bill Lawrence



Many of the species we encounter in the rainforest are found nowhere else on Earth. Here, students examine a lace monitor lizard.

A U S T R A L I A

TROPICAL REFORESTATION

Program Dates:
June 20 - August 17

Departure Point:
Cairns, North Queensland, Australia

and management efforts, and its interaction with the local ecosystem is little understood. Field trips to high density parts of its range (the well known Mission Beach management area), lectures by professional wildlife managers, scat censuses, and a habitat mapping project will augment our contributions to the database on this shy and little-known animal. In addition, we will complete the first stages of a management plan for cassowaries on the Tableland to be submitted to the newly organized Conservation Research Center in Cairns.

Case Study #3:

What is the ecological condition of select natural areas and what particular management plan for those areas would best suit the ecological, political and tourist needs?

Much of the Atherton Tableland falls within the jurisdiction of the Atherton Shire, a political unit similar to a county in the U.S.A. In response to a growing awareness of local environmental issues, the Shire Council is assessing its environmental resources and has asked us for assistance in this task. They have requested that we gather baseline data on vertebrate and plant populations in several potential reserves and make management recommendations with the goal of aiding the Shire Council in managing its ecological resources in a sustainable manner. Our objectives include determining the best techniques for conducting vertebrate and plant surveys, tabulating and evaluating the survey data to provide an environmental assessment, and devising a set of management recommendations that maintain the ecological integrity of the areas and meet the socio-political needs of the Tableland populace. Our surveys and recommendations will be presented in both oral and written form to the Atherton Shire Council.



Photo: Ed Sleshko

"Meeting members of the community like Barry Thurling was one of the highpoints of the program. He and other farmers shared with us a wealth of knowledge that we would not have gotten elsewhere: we were able to see the environment through their eyes."

Julie Rodriguez - Claremont McKenna College

Course Numbers:

BI/EE (NS) 355 Tropical Reforestation
EE 491 Directed Research

(Note: This 8 week course carries 8 semester credits.)

Case Study Question:

What are the most viable reforestation strategies for the Atherton Tableland?

Field Work Focus

- ◆ Determining what forest birds, mammals and reptiles use replanted areas, and how they affect planted rainforest succession.
- ◆ Investigating the potential for creating wildlife corridors between fragmented rainforest parks.
- ◆ Investigating the success of different tree species and planting patterns in restored areas.
- ◆ Assessing interest of local land owners in developing timber and wildlife values on their own lands.

Course Objectives

Designation as a World Heritage Site did not eliminate local pressures on the forests; struggles continue over how to manage the multi-use forests, which degraded patches to restore, and whether sustainable use is achievable given the slow pace of forest regeneration. To investigate the dynamics of reforestation, we will develop and implement a plan to

convert a stretch of farm land between two protected rainforest areas into a reforested habitat corridor. This will involve designing and assessing specific reforestation and management strategies and physically planting seedlings, some of which have been grown in the Center's shade house. We will also study the ecology and development of already planted rainforest projects.

Lectures addressing relevant topics in conservation biology, forest ecology, tropical resource management and population demographics provide a base for our fieldwork. This information will be supplemented by guest lectures on reforestation strategies. We will become familiar with a number of field research techniques such as transect use, quadrat measurement, resource mapping, and bird and animal live-trapping that will be useful in conducting our directed research projects.

SFS Faculty Profiles

Key to the SFS experience are the faculty who guide your learning adventure. These men and women are selected for their interdisciplinary teaching and research approaches as well as their leadership qualities. They are successful practitioners in careers you may be considering and are the source of a wealth of information and advice. Before coming to SFS, current staff have, for example: served as a judge in Costa Rica; worked as an environmental specialist for a Fortune 500 corporation; managed environmental impact assessments; and conducted research for the Leakey Foundation and the Gombi Stream Chimpanzee Center.

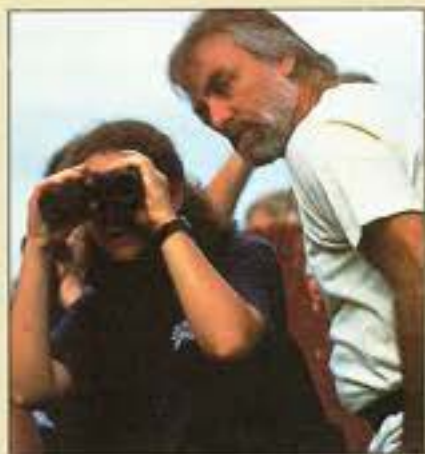


Photo: David Baigate

Center for Rainforest Studies' Field Director,
Paul Robertson

Centers are staffed by four, full-time, resident faculty (*one of whom is the Field Director*) who all live on-site for the duration of the program. Resident faculty hold an advanced degree (*often the Ph.D*) and usually have several years experience in their area of expertise at the Center location. Additional staff include part-time faculty and guest lecturers.

This level of staffing provides students with a remarkably low student to faculty ratio (*no higher than 10:1*). Teaching and mentorship are a priority for the SFS staff and, as a result, many students tell us that one of the key benefits of their SFS experience was their constant access to faculty and the opportunity to get to really know these impressive individuals.

BI/EE (NS) 371 Techniques of Wildlife Management introduces students to the questions, principles and tools used by resource managers in the Kenyan savannah ecosystem. Students will study habitat assessment, plant and animal identification, plant and animal associations and distributions, and other approaches to evaluating the savannah ecosystems. The behavioral, physiological, and social responses of animals to a changing environment will be examined. Selected field and laboratory techniques useful for monitoring ungulate populations and optimizing management practices will be presented. Decision-making processes on which wildlife management programs are based, will be addressed.

BI/EE (NS) 372 Wildlife Ecology presents students with the information and conceptual background necessary to understand the underlying ecological principles of the East African savannah ecosystem. We will focus on the fundamental processes and inter-relationships between the biotic and abiotic environment. We begin with a discussion of basic ecological principles, setting them against the background of East Africa. The factors underlying distributions, population biology and behavioral ecology will be examined along with competition and predation using African examples. Theoretical models will be discussed in light of our observations on the ranch and on field trips.

BI/EE (NS) 373 Tropical Marine Ecology discusses the interactions that determine the distribution and abundance patterns of tropical marine organisms, with emphasis on the ecology of near-shore areas. Basic principles of ecology are integrated with an understanding of the sea as a habitat for life. Physical, chemical, and geological oceanography are discussed. Major groups of dominant marine organisms of the region are described and examined in the field. Major near-shore marine habitats are examined, along with their associated biotic communities. Coral reef ecosystems are emphasized to illustrate basic concepts. Applications to the management of indigenous marine resources are discussed and demonstrated.

BI/EE (NS) 369 Rainforest Ecology introduces the structure and function of tropical rainforests including the floral and faunal components. Ecological processes that maintain biodiversity and the evolutionary processes that generate it will be presented. We will examine the dynamic relationships between plants and animals including pollination and seed dispersal. On a larger scale, we will examine tropical vegetation patterns along climatic gradients and the discuss mechanisms for preserving and restoring tropical ecosystems.

EE (NS) 370 Principles of Forest Management presents the ecological and analytical tools used in the management of terrestrial, living resources. We will use examples from the tropics and temperate regions to stress the theories and skills that provide the foundation for land management worldwide. The assessment and minimization of adverse environmental impacts caused by resource development, as well as the restoration and rehabilitation of areas suffering from chronic human induced disturbances, provide key foci for applying the principles learned in this course.

EE (NS) 374 Principles of Resource Management introduces practical tools used in addressing complex environmental problems including coastal zone planning, guidelines for ecologically-sustainable development, environmental impact assessment, fisheries management techniques, and protected-area planning and management. We will review these tools in terms of their application to local issues and to case studies from the Caribbean, the United States, Central America, and East Africa.

EE (NS) 377 Tropical Ecology and Sustainable Development examines the ecological impact of human activity, especially agriculture in a tropical country. The agroecology of important crops will be studied with emphasis on biodiversity as the source of production means and materials. Students will identify renewable and nonrenewable resources and examine their historical use by people in the region. We will study the long term and large scale impact of local agricultural and other practices on the national and global environment (*e.g. water pollution, waste management, climate change*). Options for alternative resource use, land restoration and preservation will be examined from an ecological, socio-political and economic viewpoint. Factors that constrain or promote particular options will be included. Basic field techniques and measurements will also be covered.

"As I end my tenure with SFS, I want to tell you, rather I want to emphasize, what the superlative opportunity to work for SFS has meant to me. As an SFS faculty member, I was exposed to some of the most profound experiences I've enjoyed to date, both through affiliation with professionals and students as well as exposure to natural phenomena. Close association as instructor and friend to the student body was extremely rewarding, perhaps because it demanded that I stretch my own boundaries...

— excerpt from a letter from Ann Weaver, M.S. as she leaves the SFS Faculty to pursue a Ph.D.



BI/EE (NS) 379 Coastal Ecology examines the ecological processes at the interface between land and sea in order to provide an understanding of how human perturbations can impact both marine and terrestrial systems. The watershed concept will be used to explore nutrient flow, energy cycling, erosion, coastal circulation, productivity, and biotic interactions. This course is designed to provide a basic understanding of how natural systems work in order to help guide resource managers toward ecologically sound and sustainable decisions. Field work exposes students to techniques of surveying and monitoring and the study of biotic interactions in a complex physical/chemical milieu.

EE (SS) 371 Socio-Political Systems and Sustainable Development examines the historical development of Costa Rica within an international context to understand the stages of economic, political and social development that have taken Costa Rica from social and economic isolation to a position of political and social leadership in the Central American isthmus. Topics to be discussed include 1) pre-Columbian Central American and the Meso-american influence; 2) social and economic development during the colonial period; 3) the foreign presence in Costa Rica; 4) the banana republics; 5) coffee and economic development; 6) social and economic development during the 1980s-90s.

EE (SS) 302 Environmental Policy & Socioeconomic Values provides insight into the broad social context which surrounds the natural resources under study and which will determine, in part, which approaches to resource management are practiced. Objectives include the development of an understanding of: sociocultural context including hierarchies and power structures, formal and informal decision making processes, value systems relevant to natural resources including religious factors and environmental ethics, and past and present uses of natural resources; economic factors (*local, regional, and external*); ownership patterns; attitudes and other factors that affect change and their historical bases, and legal basis for enforcement of environmental policy. The course also introduces subjects such as the major constituencies which affect conservation (*NGO conservation groups, economic interests, etc.*) and their underlying philosophies.

EE (SS) 303 Economic and Ethical Issues in Sustainable Development develops the principles and applications of Ecological Economics, or the scientific and management aspects of sustainability. Allocation, distribution and scale will be presented as parameters to assess the sustainability of development models (*at a macro and micro level*). Basic concepts of ecological economics cost-benefit valuation techniques will be presented and applied. The roles of local people, the government, and private, national, and bilateral aid agencies will be examined as constraints for the implementation of sustainable development models. We will address the problem of designing and setting up sustainable development models with communities. The empowerment of local people and their reaction to non-local proposals for sustainable development will be examined through the review of specific case studies.

EE 491 (Fall) EE 492 (Spring) Directed Research prepares students to distinguish hidden assumptions in scientific approaches and separate fact from interpretation, cause from correlation, and advocacy from objectivity. Specific tools will include experimental design, field techniques, basic descriptive statistics and parametric and non-parametric quantitative analysis. Succinct scientific writing, graphic and tabular presentation of results, and effective delivery of oral presentations will be emphasized.

BI/EE (NS) — Students choose to register for either Biology or Environmental Studies credit

EE (NS) — Environmental Studies (*Natural Science*)

EE (SS) — Environmental Studies (*Social Science*)

Liana Babbar

Field Director
Center for Sustainable Development Studies

Liana has a Ph.D. from University of Michigan's School of Natural Resources. A Costa Rican citizen, Liana conducted her thesis research on environmental impacts of the technological transformation in Costa Rican coffee production that has taken place in the past few decades. As an applied ecologist, she has hands-on experience in forestry, agroforestry and agricultural ecology. She taught natural resources and sustainable development at the Institute for Central American Development Studies, and has experience as a coordinator and educator for various field based programs such as the Organization for Tropical Studies (OTS).



Photo: Ed Stashko

Tony Cummings

Resident Faculty
Center for Rainforest Studies

A New England native, Tony Cummings earned his Master's Degree in Forestry from Yale University in 1989, with an emphasis on Wildlands Management. His field work has taken him to: the Adirondack Lakes of New York; the Monteverde Cloud Forest Reserve in Costa Rica; the Masai Mara in Kenya; and most recently, Australia. Tony has been a Resident Faculty member at the Center for Rainforest Studies since 1990, having previously taught for SFS in Costa Rica in 1989 and 1990. His courses have emphasized natural resource inventories, reforestation, plant identification, and wildlands management. In addition to his teaching responsibilities, Tony directs operations at the Center's shade house nursery.



Photo: Ed Stashko

Letter from a SFS Participant

It has been over a year since I left Kenya. Each day I find myself speaking swahili to myself or thinking of the friends I made there. I am back at the University of Colorado, doing many of the same things I did before my SFS program.

But I'm also doing things I thought only professional scientists or managers could do. I'm finishing my senior thesis studying habitat use by ferruginous hawks. Friends from my SFS program have pursued their own newfound interests: Bridgette spent the summer in the northwest working with spotted owls and bald eagles; Becca spent time as a river guide in Colorado and is now in New England working with white-tailed deer.



Photo: Niels Godfredsen

Your SFS experience will not be just about what and who you see. It will equip you to prosper and thrive anywhere you choose to be. You won't leave your experience behind when you return home. Having been challenged in your new world, and having gone beyond the initial marvel and wonder, you will find you are able to put things into ecological, environmental and conservation oriented contexts. And, that you are capable of doing many things that were once seemingly out of your reach.

Whether your SFS experience leads to more fieldwork, an honors thesis, or simply a broadened worldview, is impossible to predict. What is certain, is that it will lead to a new self-confidence and ability to solve problems. And the one thing the adventure you are about to begin will never do, is leave you.

Good luck!

Peter Coppolillo

Peter Coppolillo
Kenya Semester Participant

All SFS participants are registered at and receive credit from Boston University, which accredits SFS programs. The only exceptions are students from SFS Affiliate and Consortium schools who receive credit directly from their home institutions. *(Students from these schools should see sections on page 37 regarding Affiliate and Consortium schools).*

A non-refundable registration fee of \$150 for semester programs and \$100 for summer courses is due from all SFS students 10 days after acceptance into the program.

All SFS courses are approved and assigned course numbers by Boston University. SFS semester programs incorporate four courses and carry a total of 16 semester credits in biology or environmental studies from Boston University. Summer courses carry 4 or 8 credits in biology or environmental studies. At the conclusion of the program, you will receive an official transcript from Boston University. Many students have arranged either to transfer credit from Boston University or to receive credit directly from their home school.

The following is a partial list of the home schools of previous SFS participants. Over 200 institutions, including the majority of these schools have accepted or awarded credit for SFS participation. As the final decision regarding credit transfer rests with the home institution, **you should check with your advisor/registrar before going into the field.** Many schools award credit on a case by case basis and credit granted to previous students does not imply automatic credit approval.

Albion College
Allegheny College+
American University
Amherst College
Barnard College
Barry University
Bates College
Baylor University
Bennington College*
Berea College
Boston College
Boston University
Bowdoin College
Brandeis University*
Brown University
Brigham Young University
Bryn Mawr College
Bucknell University
Carnegie Mellon University
Case Western Reserve University
Claremont-McKenna College
Clark University*
Colby College*+
College of Charleston
College of William and Mary
College of the Atlantic
Colorado College
Colorado School of Mines
Connecticut College
Cornell University
Dartmouth College
Davidson College*
Denison University*
Dickinson College*+
Drake University
Drew University
Duke University
Emory University
Evergreen State College
Framingham State College
Franklin and Marshall College
Franklin Pierce College
Georgetown University
George Washington University
Gettysburg College
Goddard College
Guilford College
Hamilton College
Hampshire College
Harvard College
Hiram College*
Holy Cross College

SFS Affiliate Program

The SFS Affiliate Program was initiated with the goal of helping students to maximize their SFS experience by building better linkages to the academic community from which SFS students are drawn. Students from Affiliate institutions receive preferential admission and financial aid from SFS. The home schools provide direct academic credit for SFS participation and have curricular input into the SFS program. In addition, an SFS liaison has been identified at each affiliate school who is available to provide on-campus advising on SFS programs. Applicants from Affiliate schools must obtain permission to participate from their campus Affiliate Representative. The current SFS Affiliate Representatives are:

Bennington College
- Dr. Kerry Woods

Brandeis University
- Dr. Attila Klein

Clark University
- Dr. Todd Livdahl

Colby College
- Dr. David Firmage

Davidson College
- Dr. Verna Miller Case

Denison University
- Dr. Juliana Mulroy

Dickinson College
- Dr. Janet Wright

Hiram College
- Dr. Matt Hils

Kenyon College
- Dr. Ray Heitbaas

Miami University
- Dr. Donald Kaufman

Mount Holyoke College
- Ms. Joanne Picard

Scripps College
- Ms. Valerie Eastman

S.U.N.Y. College of Environmental Studies & Forestry
- Dr. Neil Ringler

University of Miami
- Dr. Dan DiResta

Wells College
- Dr. Thomas Vawter

University of Alberta
University of California/Berkeley
University of California/Los Angeles
University of California/Santa Cruz
University of California/San Diego
University of Cincinnati
University of Colorado
University of Connecticut
University of Iowa
University of Kansas
University of Maryland
University of Massachusetts
University of Miami*
University of Michigan+
University of Minnesota
University of New Hampshire
University of North Carolina
University of Pennsylvania
University of Pittsburgh
University of Puerto Rico
University of Puget Sound
University of Rhode Island
University of Tennessee
University of Utah
University of Vermont
University of Victoria
University of Virginia
University of Wisconsin
Vanderbilt University
Vassar College
Villanova University
Virginia Polytechnic Institute and State University
Warren Wilson College
Washington University
Washington and Lee University
Wellesley College
Wells College*
Wesleyan University
Whitman College
William Smith College
Williams College
Wittenberg University
Xavier College
Yale College

+ Member of Sustainable Development Studies Consortium

*** SFS Affiliate School**

Humboldt State University
Ithaca College
Kenyon College*
Knox College
Lehigh University
Lewis and Clark College
Macalester College
Marlboro College
McGill University
Miami University*
Middlebury College+
Mills College
Mount Holyoke College*
Mount Union College
New York University
Northeastern University
Northwestern University
Oberlin College
Occidental College
Ohio State University
Ohio University
Ohio Wesleyan University
Oregon State University
Pennsylvania State University
Pitzer College
Pomona College
Prescott College
Providence College
Purdue University
Randolph Macon College
Rutgers University
Saint John's College
Saint Lawrence University
Saint Michael's College
Saint Olaf College
Salem College
Scripps College*
Shimer College
Simon's Rock of Bard College
Skidmore College
Smith College
Stanford University
Stockton State College
S.U.N.Y. College of Environmental Sciences and Forestry*
Swarthmore College
Trenton State College
Trinity College
Trinity University
Tufts University
Tulane University
Union College

The Sustainable Development Studies Consortium

The Studies in Sustainable Development Program in Costa Rica was created through the joint efforts of SFS and the Environmental Studies Programs at **Allegheny, Colby, Dickinson and Middlebury Colleges and the University of Michigan** to provide an intermediate level field study opportunity. A portion of the spaces in the semester program are reserved from students from Consortium schools. **Students from these schools should contact their Environmental Studies Departments for more information on the program, credit and application procedures and deadlines.** Students from all other schools should contact the SFS Admissions Office for further information. Sustainable Development Studies Consortium Representatives are:

Allegheny College
- Dr. Eric Pallant

Colby College
- Dr. David Firmage

Dickinson College
- Dr. Candice Wilderman

Middlebury College
- Dr. Stephen Trombulak

University of Michigan
- Dr. Jane Leu

Photo: Bill McComas



Occasional moments for private reflections are treasured as living and working with a group of 40 individuals day in and day out presents both challenges and rewards.

Requirements for Admission

Admission to SFS courses is open to eager, motivated students. A strong background in science is not required. Participants are screened by the Admissions Committee to insure that they are choosing the right course for the right reasons. If you are willing to commit your emotional, intellectual, and physical energies to working toward a better understanding of crucial environmental issues, we encourage you to join us.

We are seeking a body of curious students with a thirst for learning and the maturity and personal initiative to make use of our unique educational opportunities. Applicants should exhibit enthusiasm, character, compassion, flexibility and social concern. Also evident should be a demonstrated promise to benefit academically and socially from this experience as well as a willingness to, at times, put the needs of the group ahead of your own. The essay in which you define your motivation for participating in an SFS program is a strong determining factor in the admission process.

Before completing your application for admission, we would like you to carefully consider the fact that this experience will likely be very different from your academic experience to date. We are setting off together on a journey during which we ask that you consider yourself to be crew not passengers. We expect and encourage you to take a proactive role in all aspects of your education from scheduling activities to choosing research projects to risk management.

HOW TO APPLY

An Application for Admission and SFS Reference Form can be found at the back of this catalogue.

All applicants for admission are required to submit an SFS application form and essay, a \$35 application fee and an SFS reference form before the application will be reviewed.

Applicants for semester programs should be 18 years of age and have completed at least one college-level ecology or biology course and one semester of college. Semester applicants must submit an official, current transcript to complete their application.

Applicants for summer courses should be at least 16 years of age and have completed at least the junior year in high school. Applicants who have not entered college must submit a transcript.

For further information regarding admission, please call the SFS Admissions Office at

508-927-7777

Acceptance

Applications for all programs are reviewed on a rolling admission basis, as soon as all required information is received. The Admissions Committee meets on the 1st and the 15th of every month. *Teams fill quickly. We strongly urge you to apply early to join the course of your choice. Waiting lists are maintained for courses that fill early.*

All acceptances are contingent upon medical approval. Course syllabi will be sent to all accepted applicants.

Financial Aid

We are committed to involving as many qualified students as possible in SFS programs and will work with you to insure your participation in an SFS program. SFS has been the recipient of generous contributions from foundations, corporations and individuals to help realize this goal.

Financial aid, in the form of scholarships and/or interest free loans, is available to qualified students based on need. We have historically assisted approximately 28% of our participants and we hope to continue this level of funding. For the 1995-96 academic year, we expect to have over \$250,000 in scholarship and \$250,000 in loan funds to make the SFS experience accessible to over 200 students facing financial challenges. Some applicants receive a combination grant and loan while others receive only loan funding. You do not need to be receiving financial aid at your home school to qualify for SFS financial aid for summer or semester programs.

If you will need financial assistance in order to participate, we strongly encourage you to request, complete and return an SFS Financial Aid Application as soon as possible. Aid is available by need until funds are exhausted. For more information on how to qualify for assistance, please call the SFS Admissions Office at (508)927-7777.

Semester students: In determining need, we expect that you and your parents will contribute at least the same amount that you are paying per semester at your home school, and more if you are able. A growing number of schools allow students to take some or all of their institutional financial aid off-campus. Check with your financial aid office to see what aid you can apply to your SFS program. We encourage you to investigate applying for federal financial aid funds including Stafford Loans through your home school.

Expectations and Responsibilities

Changes and Cancellations

SFS programs are obviously different from travel or adventure programs. We have tried to give accurate portrayals of every program in this catalogue. All course descriptions have been written in consult with a current or past faculty member. However, each project is unique and often cannot be implemented exactly as planned for a variety of reasons. There are factors which, although monitored closely, are beyond our control. For example:

- ◆ Over half of our projects take place in highly regulated and sensitive environments, usually requiring special permits, such as in Kenya and Palau.
- ◆ Some projects depend on the goodwill and generosity of individuals and institutions which lend support.
- ◆ Tenuous weather situations, natural disasters or changes in political conditions in another country may require last-minute changes in sites or research plans.

You are advised that these or other variables (*including staffing*) may result in changes before or during a course. As the course catalogue is often written up to a year before a program actually goes into the field, students should rely on their program syllabus for up-to-date course descriptions. Indeed, part of your challenge lies in adapting to changing conditions and overcoming the obstacles they may present. In other words, the elephants are not always where we want them to be, so please be flexible.

Student Conduct

You are expected to conduct yourself in a mature and responsible manner. SFS reserves the right to require any participant to withdraw from any program at any time if the faculty deem the student's conduct to be detrimental to or incompatible with the interest, harmony, comfort or welfare of the course - including use of alcohol or drugs not authorized by a medical doctor, or uncooperative or disruptive behavior. Should such a decision be made, SFS will notify your parents and return you to the point of course departure, at which time any and all responsibility on the part of The School for Field Studies will cease.

Responsibility

In organizing and managing these courses, The School for Field Studies (SFS), its agents, employees, and staff give notice that they act solely on behalf of and for the benefit of the participants, on the express agreement that SFS shall not be liable, financially or otherwise, for non-performance or unsatisfactory service; for injury to persons including death; for loss of, or damage to property; for accident or delay; and/or for expenses arising from strikes, weather, quarantine, sickness, government regulation, or from any act or omission of it's agents or employees, and/or airline, railroad, bus company, automobile rental agency, hotel, or other supplier of service.

The School for Field Studies is a charitable corporation located in Beverly, Massachusetts, U.S.A. All matters relating to or arising out of or involving in any way your relationship with SFS shall be governed by Massachusetts law and any legal dispute shall be determined by a Massachusetts court.

SFS reserves the right to refuse any applicant admission to any program if he/she is deemed unsuited for the project for any reason. All courses, fees, and dates are tentative until verified and confirmed in writing by The School for Field Studies.

The School for Field Studies admits students of any sex, religion, race, color, national or ethnic origin to all the rights, privileges, programs, and activities generally accorded or made available to students of the School and does not discriminate on the basis of sex, religion, race, color, national or ethnic origin in the administration of its educational policies, admissions policies, scholarship loan programs, and other School-administered programs. SFS is an equal opportunity institution.



Photo: Chris Vaughan

"It was the most intense learning experience of my entire life. A complete ecological, social, academic, and intellectual immersion in the concept of sustainability."

Frederick Werner, Chevy Chase, MD • University of Michigan

Because the credits you earn for your SFS participation will, in all likelihood, be applied toward your degree, your school can process a Stafford Loan to assist your participation in an SFS program. If necessary, SFS and Boston University can sign a consortium agreement indicating that we will not be awarding you federal financial aid. If you encounter difficulty in arranging to use federal financial aid funds for your SFS program, please ask your financial aid officer to give us a call and we will try to help you out.

Scholarship Donors

Generous support from numerous individuals and the following have made the SFS Financial Aid Program possible:

The Andreas Foundation
 The Charles Engelhard Foundation
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 The Merck Family Fund
 The Curtis and Edith Munson Foundation
 The Laurance S. Rockefeller Trust
 The Explorers Club
 Archer Daniels Midland Company

Tuitions, Costs and Refund Policies

Deposits, Tuitions and Fees

Like other non-profit, tax exempt educational institutions, SFS meets its expenses with a combination of tuition charges and income from grants and donations. Your tuition pays for instruction, room and board, and ground transportation during the course. It also covers group equipment, medical supplies, scientific instruments and material. ***It does not include transportation to and from the departure point.***

A non-refundable deposit of \$350 for summer courses or \$500 for semester programs is due no later than 10 days following acceptance in order to reserve a place in the program. All students will be registered for academic credit. A non-refundable registration fee of \$100 for summer courses or \$150 for semester programs is due with your deposit. ***(Deposits and registration fees for financial aid candidates are non-refundable 10 days following financial aid offer. You must complete and return the financial aid application within 10 days of acceptance to qualify for refund status.)***

Full tuition is due sixty days prior to course departure. You will not be allowed to participate in the program with an outstanding tuition balance. ***Note: The tuition fees listed in this catalogue are based on estimates made up to a year in advance of departure and involve many variables - currency rate, outside project support, enrollment projections, etc. - all of which may change. The tuition for each program is tentative until confirmed in writing by SFS.***

In addition to tuition charges, please also consider the following to determine the total cost of participation:

Transportation and Travel

Arrangements: To insure orderly arrival at the site as well as low fares, we work with one travel agency to handle all travel. This agent will arrange travel to the program, with any special

Tuition

SFS Fall 1995 and Spring 1996 Semester Programs \$10,970

(All semester programs have an additional \$150 registration fee)

Summer 1995 Programs (30 Days)

(All summer programs have an additional \$100 registration fee)

Community Wildlife Management/KENYA	\$ 3,220
Marine Parks Management/CARIBBEAN	\$ 2,950
Alternative Strategies for Preserving Tropical Ecosystems/COSTA RICA	\$ 2,790
Conserving Marine Resources and Coastal Rainforests/CANADA	\$ 2,650

(60 day programs)

Tropical Reforestation/ AUSTRALIA	\$ 5,250
Management of Tropical Island Resources/PALAU	\$ 4,980

arrangements you require. If you do not use the SFS agent, special conditions apply and you must have your travel plans approved by the SFS Admissions Office. You will receive specific travel details after your acceptance. You are responsible for passport/visa fees as well as all transportation costs to and from the departure point.

Clothing and Equipment: SFS will provide food, cooking equipment, tents and all scientific and research equipment. You are responsible for personal gear including sleeping bags, backpacks, clothing, SCUBA gear (if applicable). You may find you already have much of what you need.

Physical Examination and Medical Insurance: You must present a completed SFS Medical Form, signed by a doctor, no later than 30 days before program departure. Students with late medical forms may forfeit their space. All medical forms must be approved by the SFS Medical Committee. You must be able to meet the physical challenges presented by SFS programs without undue risk to yourself or others. Academically qualified individuals may be disqualified from participating on medical grounds. You will not be allowed to join an SFS program without proof of up-to-date medical coverage and a signed medical release.

Refund Policies

Summer Courses: Registration fees are non-refundable and non-transferable. Deposits are non-refundable. If you withdraw prior to 21 days before the start of the course, it may be possible to transfer your non-refundable deposit to another SFS program within a 12 month period. If you withdraw 21 days or less before the start of your course, SFS will retain 50% of the course tuition. No refunds are made as of the first day of the course.

Semester Programs: Registration fees are non-refundable and non-transferable. Deposits are non-refundable. If you withdraw more than 30 days prior to the start of the program, SFS will retain 50% of the program tuition; it may be possible to transfer your non-refundable deposit to another SFS program within a 12 month period. If you withdraw from a course 30 days prior to the program commencement to 14 days after the program departure, SFS will retain 75% of the tuition. No refunds are made after the second week of the program or to students asked to leave the program.

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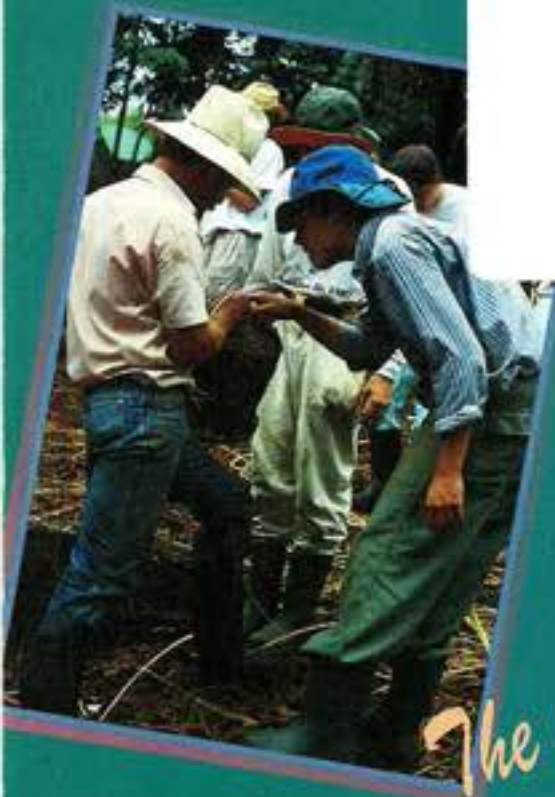
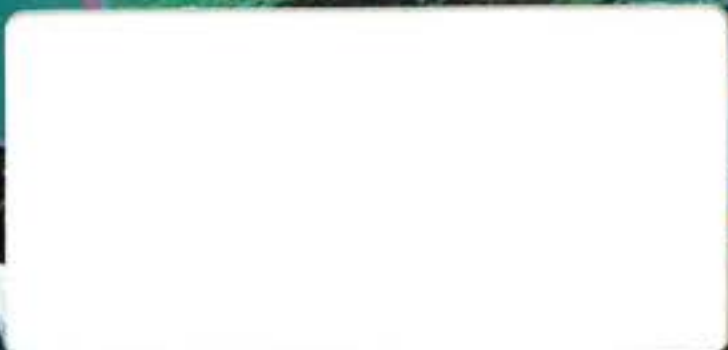
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Semester Program: *Wildlife Ecology & Management*
Summer Course: *Community Wildlife Management*

The Center for Marine Resource Studies – CARIBBEAN

Semester Program: *Marine Resource Management*
Summer Course: *Marine Parks Management*

The Center for Coastal Studies – PACIFIC NORTHWEST CANADA

Semester Program: *Coastal Rainforests & Marine Resources*
Summer Course: *Conserving Marine Resources & Coastal Rainforests*

The Center for Island Management Studies – REPUBLIC OF PALAU

Semester Program: *Island Management Studies*
Summer Course: *Management of Tropical Island Resources*

The Center for Sustainable Development Studies – COSTA RICA

Semester Program: *Studies in Sustainable Development*
Summer Course: *Alternative Strategies for Preserving Tropical Ecosystems*

The Center for Rainforest Studies – AUSTRALIA

Semester Program: *Tropical Rainforest Management*
Summer Course: *Tropical Reforestation*

