

where science and
nature converge

NEWS FROM THE

li·a·na \lē-'ān-ə, 'an-ə\ n. **1** : A climbing herbaceous or woody vine especially of tropical rain forests that roots in the ground, **2** : The bi-annual newsletter published for friends of the Organization for Tropical Studies.

The Organization for Tropical Studies is a nonprofit consortium of 65 universities and research institutions in the U.S., Costa Rica, Peru, Canada, Mexico, South Africa, and Australia. Founded in 1963, OTS is dedicated to providing leadership in education, research and the responsible use of natural resources in the tropics. To this end, OTS offers graduate, undergraduate and professional education, facilitates research, participates in conservation activities, conducts environmental education programs and maintains three biological stations in Costa Rica: La Selva Biological Station in the Atlantic lowland rainforest; Palo Verde Biological Station in the Pacific deciduous dry forest; and Las Cruces Biological Station in the premontane cloud forest near the Panamanian border.



**Organization for
Tropical Studies**

www.ots.duke.edu

Liana

ORGANIZATION FOR TROPICAL STUDIES

E.O. Wilson to Deliver Keynote at OTS 40th Anniversary Symposium

Edward O. Wilson, one of the founders of OTS and preeminent biological theorist, will deliver the keynote address at the Organization's 40th Anniversary Symposium on April 3rd 2003 in San José, Costa Rica. Wilson's accomplishments include pioneering work on chemical communication, featuring the first comprehensive account of pheromones in ants; the creation (with Robert H. MacArthur) of the theory of island biogeography; and the creation of the discipline of sociobiology. He also edited *Biodiversity*, which introduced the term and launched worldwide attention to the subject. Today, he continues entomological and environmental research at the Museum of Comparative Zoology at Harvard University. Two of his 21 books have been awarded Pulitzer prizes. His most recent book, *The Future of Life*, offers a plan for saving Earth's biological heritage. Wilson has received 75 awards of international recognition for his contributions to science and humanity, including the U.S. National Medal of Science.

For complete information on the Symposium and related activities, see page 12. ☞



Symposium to Feature E.O. Wilson and other Notable Tropical Scientists

JON CHASE/HARVARD NEWS OFFICE 1996

Undergraduates Get First-Hand Look at Challenges and Rewards of Tropical Field Research

The OTS Research Experiences for Undergraduates (REU) program was established with funding from the National Science Foundation for students interested in conducting field research under the supervision of an experienced tropical ecologist. Evan Notman (OTS) coordinated the summer program. Ten undergraduates, selected through a competitive application process (more than 170 students applied), spent ten weeks at La Selva Biological Station. In collaboration with a research mentor, students designed, conducted, and presented field research projects. The students also participated in a rich academic field environment, including research presentations, discussions, and an ethics component focusing on issues in tropical biology and conservation. Applications for the summer 2003 REU are due January 17, 2003 and the program is open to U.S. citizens and Permanent Residents who are undergraduate students enrolled in accredited institutions in the U.S.

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PETE CARMICHAEL

As we enter our 40th year of operations, I am reminded of the vision of our founders. In 1963 nine universities recognized the need for graduate-level, science-based field courses in the tropics. Graduate students were not being exposed to field research in one of the most complex ecosystem on earth and home to nearly 70% of the world's biodiversity—the tropics. In order to operate the most cost-effective and high quality programs, these universities collaborated with the University of Costa Rica to form the Organization for Tropical Studies

and offer the first-ever graduate field courses in tropical biology. Although we have expanded to reach additional markets, we continue to be true to the vision of our founders by providing the best tropical field courses in the world.

I invite you to join us as we celebrate our accomplishments and look toward the future of education, research and conservation in the tropics. The Organization's 40th activities will include a week-long event in Costa Rica March 30-April 5, 2003. Tropical Biology (Rubber) Boot Camps will give participants an

opportunity to experience an OTS style course led by veteran coordinators and resource personnel. The one-day scientific symposium, "Tropical Science for the 21st Century" will include presentations by today's scientific leaders and a poster session featuring important tropical research. The Celebration Banquet will provide an opportunity for networking and fellowship. These events are open to professionals in academia and research, OTS alumni, assembly members and friends of the organization. See page 12 for more information. I hope to see you there. 🌿

Undergraduates Get First-Hand Look at Challenges and Rewards of Tropical Field Research *continued from page 1*

STUDENT PERSPECTIVE: Sari De'Ann Hopson, University of North Carolina – Chapel Hill

The REU program offered me the opportunity to conduct hands-on tropical biology in the Costa Rican rain forest. My research project was titled 'A mathematical model of the *Piper cenocladum* plant system.' I was partnered with Toby Gershon, a student at the University of Maryland, and our mentor was Dr. Bob Matlock, La Selva Scientific Director. The plant system we studied consists of the mutualistic relationship between the plant *Piper cenocladum* and the ant *Pheidole bicornis*. In this relationship the ants reside in the hollow petioles of the plant and patrol the plants leaves to protect it from herbivory. The ants eject herbivorous caterpillar larvae (which are oviposited by moths) from the surface of the leaf. In return, the plant produces food bodies and provides shelter for the ants. During the ten weeks of the program we obtained data from field experiments to mathematically model the plant-ant system.

We performed field experiments that allowed us to estimate two parameters in our mathematical model of the plant-ant system. These two parameters were density independent ant colony death rate and rate of colonization of empty plants by ants. *Piper cenocladum* tends to grow well in swampy areas, therefore our plots were found in this type of environment. Most of these swampy areas were at the base of steep, muddy, slippery hills that we had to descend—needless to say this resulted in us being muddy from head to toe after every venture to our plots. While in the field, we narrowly avoided encounters with peccaries, venomous snakes, and white-faced capuchin monkeys, who liked to drop seeds and seed pods on the heads of unsuspecting field researchers. The whole experience of being in a rain forest and observing the natural habitats of many species was captivating.

From this experience I learned that field ecology requires a lot of dedication on the part of the researcher. The researcher must be thoroughly interested in his/her research and willing to be subjected to many types of weather or environmental obstacles. These obstacles include heavy rain, extreme heat, and the presence of dangerous animals in the surrounding areas of the researcher's plots. While I learned a great deal from this experience, I also learned that field ecology is not a career path that suits my personal interests. The REU program allowed me to put things into perspective and helped me to realize what things about scientific research are of interest to me. What I found was that I am more interested in the wider telescopic picture when it comes to scientific research rather than individual microscopic aspects of science. This helped me to narrow down my options for future study and



I wanted to be exposed to another side of biology other than textbook readings and lectures and to find out whether a career in field ecology would be of interest to me.

Sari De'Ann Hopson

OTS apologizes to University of Georgia graduate student Beth Anderson, whose information was used in the last *Liana* article on Sarapiquí dam projects without attribution.

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OTS Course Application Deadlines

graduate

- TROPICAL BIOLOGY ASSOCIATION COURSES IN EAST AFRICA AND MADAGASCAR: FEBRUARY 15, 2003
- STRI-OTS TROPICAL MARINE ECOLOGY: MARCH 1, 2003
- SISTEMÁTICA DE PLANTAS TROPICALES: NOVEMBER 1, 2002
- ECOLOGIA DA FLORESTA AMAZÔNICA: APRIL 18, 2003
- TROPICAL BIOLOGY: AN ECOLOGICAL APPROACH: MARCH 15, 2003
- ECOLOGÍA TROPICAL Y CONSERVACIÓN: JUNE 13, 2003

undergraduate

- RESEARCH EXPERIENCE FOR UNDERGRADUATES: JANUARY 17, 2003
- FIELD TROPICAL ECOLOGY: FEBRUARY 14, 2003
- INTRODUCTION TO FIELD ETHNOBIOLOGY: FEBRUARY 14, 2003
- FALL SEMESTER ABROAD 2003: MARCH 7, 2003

Academic Director Nora Bynum left OTS in August to take the position of Project Director for the International Network of Conservation Educators and Practitioners affiliated with the American Museum of Natural History. Nora did an outstanding job in growing, strengthening, diversifying and professionalizing our academic portfolio. We will miss her commitment to and leadership in education and wish her all the best in her future endeavors.



Academic Director Nora Bynum leaves OTS after 5 years leading the education program.



3M INITIATIVE: MULTI-SITE, MULTI-INVESTIGATOR, MULTI-DISCIPLINARY INITIATIVE FOR TRAINING PLANT ECOLOGY GRADUATE STUDENTS

Training through the 3M Program disseminated the work of Mellon-funded scientists taking place at six major research sites to a new generation of scientists focused on tropical and subtropical plant ecology. The unique value of the 3M Program lies in locating the modules at intensively studied sites in tropical and subtropical ecosystems. The six modules for the Program have taken place over a two-year period, with three during August–September 2001 (Hawaii, Costa Rica, Brazil) and three in July–September 2002.

The 2002 module sites were in

South Africa, Panama, and Peru. The South Africa Module—run by Kevin Rogers, Ed February, William Bond, and William Stock—focused on the heterogeneity and adaptive management of savanna ecosystems. It provided an introduction to the biotic and abiotic characteristics of savanna ecosystems, the role of humans in savannas and conservation of Kruger National Park. Special emphasis was given to how climate, fire and large herbivores interact in determining ecosystem properties in these savannas. The Panama Module was coordinated by Allen Herre and exposed

participants to a wide range of habitats associated with the Barro Colorado Nature Monument in Panama. While in Panama, 3M participants held an all-day symposium attended by several site coordinators; they also attended the annual Association for Tropical Biology meeting hosted by STRI and OTS. Cocha Cashu Biological Station in Manu National Park was the site for the Peru Module, conducted by John Terborgh, Nigel Pitman, and Miles Silman. Cocha Cashu is set in a highly dynamic floodplain environment within a rare example

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STUDENT PERSPECTIVE:

Sari De'Ann Hopson *continued from page 3*

career paths to either environmental sciences or epidemiology. The program helped me to understand what actually goes on in the research planning and implementing processes. I learned how to handle research setbacks, how to examine the feasibility of a project idea, and how to conduct research and collect data. All of these things will enable me to be a better researcher in the future in whatever area of science I decide to pursue.

I also learned to appreciate the beauty and natural environment of the rain forest. I realized the importance of conserving natural resources in the tropics. While in Costa Rica it was brought to my attention that many plant and animal species that were prevalent just a few years ago now have steadily declining populations. Most of all, I realized that only humans have the ability to consciously change their behavior in ways to protect the environment and prevent the decline of the many populations in ecosystems throughout the world. Finally, I will use this knowledge to not only change my behavior when it comes to environmental issues, such as pollution, but also to influence my peers to behave responsibly when doing things that may affect the environment in which we, along with many other species, live.

STUDENT PERSPECTIVE:

Angel Hsu, Wake Forest University

When I first entered college, I learned the concept of one's 'comfort bubble' — the proverbial bubble that encases a person's comfort zone and protects one from the terrifying UNKNOWN. Admittedly, we all have these comfort bubbles as security blankets, and we have all said once in our lives 'Now THAT is where I draw the line.' The minute I began my summer conducting independent research in the REU Program at La Selva Biological Station in Costa Rica, however, my established comfort bubble completely burst as I was now forced to test my limits to their extremes while in the field. Spiders no longer became a source of fear and disgust; I somehow discovered a sense of direction; the act of being covered head-to-toe in mud became a daily norm; and the avoidance of snakes and stinging insects became almost instinctual. As unglamorous as this may sound, I loved and cherished every minute researching, learning, and experiencing in Costa Rica.

I came into the REU program perhaps the least experienced of all my peers. I had only completed one year of college, and, while the other students in the program were all intense Biology majors at their respective colleges, I was coming into the program trying to decide whether or not biology was the right concentration for me. I worked with Lee Dyer of Tulane University on his long-term study of the *Piper cenocladum* ant-plant system. *P. cenocladum* is a common understory shrub located in the lowland rain forests of Costa Rica that has

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of a large-scale ecological system supporting an intact flora and fauna in which natural process regimes function without human influence. Thus, the major themes of the Manu Module emphasized forest structure and the dynamic processes that maintain a landscape mosaic within a floodplain.

WHAT HAPPENS WHEN A COURSE INCLUDES 8 HERPETOLOGISTS?

TROPICAL BIOLOGY: AN ECOLOGICAL APPROACH 02-3

by Deedra McClearn, Coordinator

This offering of the wet season course consisted of six men and 17 women, including two students from our new OTS member institution, the University of Alberta. The course had a particularly strong emphasis on conservation, land management, and biodiversity issues. Student research included



Field problems employed observations and experiments to test hypotheses, and were followed by data analysis and presentation of results.

Pablo Arroyo's survey of *Dipteryx panamensis* trees at La Selva that he had planted in 1995 as part of the TRIALS project. Brian Horne and Abbie Sorenson recaptured turtles marked years ago at Palo Verde and La Selva and provided important data on growth and demography of these populations. One of their important findings was how destructive the burning of cattails in the Palo Verde marsh is to turtles. Jeanne Robertson reexamined the streams at Las Alturas to extend the work on amphibian declines of her former Master's thesis advisor, Karen Lips (see article on chytrid fungus on page 15). Jeanne described Karen's diligent boot washing ritual to the other students who wholeheartedly agreed to make it an official OTS course practice. The chytrid fungus, which is related to amphibian declines, can be spread to other reserves and parks on the boots of researchers. Boots and equipment used in aquatic research were soaked in a solution of bleach and water. This practice established an excellent mind-set among the students who will be researching, and washing boots, in the tropics.

PROFESSIONALS AND ADVANCED STUDENTS TRAINED IN SUSTAINABLE AGRICULTURE

AGROECOLOGÍA TROPICAL 02-7

José Manuel Mora (University of Costa Rica), coordinator, and Mickie Swisher (University of Florida), co-coordinator, led 14 students from 8 countries as they examined the relevance and applicability of ecological theory and principles to tropical agroecosystems. Students examined several agroecosystems, emphasizing biological diversity measures, sampling methods, and collection

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and analysis of socioeconomic data. Students came away with enhanced abilities to understand and apply scientific methods to the study of agricultural ecosystems.

**STUDENTS GAIN
BROAD KNOWLEDGE OF
PLANT RELATIONSHIPS AND
CLASSIFICATION
TROPICAL PLANT
SYSTEMATICS 02-9**

Brad Boyle (University of Arizona) and Robbin Moran (New York Botanical Garden) led this six-week field introduction to the identification, inventory, classification and phylogenetic analysis of tropical vascular plants. Half of the 22 students had major interests classified as “systematics.” The other 11 students represented a broad range of interests in ecology, evolutionary biology, anthropology and paleobotany/palynology. The ratio of systematists to other disciplines made for an interesting mix of ideas and interests. The course began with a classroom- and lab-intensive week at Las Cruces, where students were given an overview of vascular plant phylogeny, phylogenetic theory, and plant morphology. They also did skills workshops covering specific techniques to use throughout the course. Students spent 6 days each at 4 field stations representing a sample of major tropical habitats and associated taxa. Students collected plants in the field, conducted identification reviews and a vegetation survey (transect). In addition, they devoted time to group and independent projects, interspersed with specific taxonomic and skills workshops. In San José students worked at one or both of the two major herbaria (INBio and the Museo Nacional), collected additional information from specimens for their group (cladistic analysis) and independent projects. Finally, students wrote and presented independent research projects.

**PORTUGUESE SPEAKING
GRADUATE STUDENTS STUDY
BRAZILIAN AMAZON ECOSYSTEMS
ECOLOGIA DA FLORESTA
AMAZÔNICA 02-12**

This course was offered by the Instituto Nacional de Pesquisas da Amazônia (INPA), the Smithsonian Institution and the Universidade Estadual de Campinas (UNICAMP). Emphasis was on the ecology of flooded and *terra firme* forests in the region around Manaus, Brazil. Two full scholarships were awarded to U.S. students. Full scholarships will be available for U.S. citizens/permanent residents at OTS member institutions for the 2003 offering of this course.

**LATIN AMERICAN STUDENTS
STUDY THE PERUVIAN AMAZON
ECOLOGÍA DE ECOSISTEMAS
AMAZÓNICOS 02-13**

The fourth offering of this Spanish-language course in the Peruvian Amazon was led by Grace Servat (University of Missouri-St. Louis) and co-funded by the Amazon Center for Environmental Education and Research (ACEER). The course included 22 students (selected from 65 applicants) from 9 countries. For the first time, this course split its time between northeast and southeast Peru. The course visited Madreselva (Loreto) where emphasis was on the ecology of the flooded forests and aquatic habitats. The second part of the course took place at Los Amigos (Madre de Diós) where the focus was on mainland forest ecosystems and biodiversity. Days began at 6 am with orientation walks, independent research and group projects. Evening sessions were full with seminars by students, coordinators, teaching assistants, and invited professors.

**YOUNG MOLECULAR
SCIENTISTS INTRODUCED TO
TROPICAL SYSTEMS
MOLECULAR METHODS
IN TROPICAL ECOLOGY 02-17**

In this pioneering course, coordinators Harvey Ballard (Ohio University) and Pedro León (University of Costa Rica)



HARVEY BALLARD

Students developed critical skills central to the use of molecular techniques in tropical ecology studies.

demonstrated how molecular approaches can be used to address issues of population genetic variability, paternity analyses, and species interactions that underlie many of the topics traditionally addressed in OTS field courses. Molecular approaches were employed to explore key issues in tropical ecology and systematics, such as DNA extraction from different organisms, sequence analysis, population genetic and phylogenetic analyses, project and experimental design and hypothesis testing in molecular biology. The first week and a half of the course consisted of lectures, laboratory demonstrations, skills and analyses workshops, and orientation to the ecosystems of La Selva. The final weeks of the course were devoted to the development, implementation, analysis and presentation of independent research projects.

THE 5TH FOREST

The *Advanced Comparative Neotropical Ecology Course*, known as “4 Forests”, added another site to their comparative studies. In September 2002, OTS and the French CNRS funded the participants to travel to French Guyana to explore the well-studied biological reserves in the vast expanse of the Guyana Shield region. This 5th forest, the least disturbed area studied, allowed the students to expand comparative research. 🌿

STUDENT PERSPECTIVE:

Angel Hsu *continued from page 5*

mutualist ants (*Pheidole bicornis*) living in the hollowed petioles of the plant. The system is representative of a top-down controlled trophic cascade, and I was interested in investigating whether or not bottom-up controls via plant secondary compounds (*Piper* amides in the case of the *P. cenocladum* study system) are effective regulators of specialist geometrid larvae or generalist herbivores, orthopterans and the leaf-cutting ant *Atta cephalotes*. I went to the field daily to collect the geometrid larvae and orthopteran predators from *P. cenocladum* plants, and I reared them on shadehouse leaves grown under varying conditions of top predator presence, shade, and fertilizer. Dyer's work has shown that the concentrations of *Piper* amides vary according to these factors: in plants where ant-mutualists are not present, concentrations of the amides are almost three times greater than the concentration of amides in plants with ant-mutualists. Although my mentor and I are still analyzing my results, we are already seeing a significant relationship between the total amide content of leaves and growth of the specialist geometrid larvae.

The REU program was an incredible first-time field experience. I was exposed to more aspects of biology and ecology than I thought existed; I met researchers from all over the world and learned about their work; but more importantly, I was given the opportunity to be a scientist and a researcher. I went into the field alone every day, and I realized that creativity goes a long way when dealing with problems arising in a project. The entire time I was in Costa Rica, I just couldn't believe that I was receiving this amazing opportunity to research and study in such a beautiful country.

Although the REU program thoroughly convinced me to become a Biology major and I plan on a career intermingling both science and my interests in conservation and environmental policy. While I was researching in Costa Rica, I witnessed first-hand the special relationship of people and nature. The Costa Ricans I worked with at La Selva knew so much about the rain forest, and, through their love and knowledge of the forest, I was able to learn so much about their culture and conservation. Because tourism is a large component of the country's livelihood, the people realize the importance of conservation. Costa Rica is a shining example of a country that is able to incorporate conservation and economy, and I hope to work with developing nations as they adopt environmentally conscious policies.

There are many lessons that can be learned from the jungle. I learned that one cannot cling to comfort, such as the predictability of the beans and rice served at La Selva, to truly experience the rain forest and to learn. I also learned that the trails are not always paved in the jungle, either. You must sometimes find your own way through the forest, and, in my case, I learned that I must forge my own future career path intermingling both science and environmental policy. 🌿



SPRING 2002 SEMESTER ABROAD

The 18 students from 16 U.S. institutions spent the semester learning the fundamentals of tropical biology, doing field research and studying environmental policy, and Spanish and Latin American culture. Faculty led a number of research projects, including seed predation and recruitment in high altitude forests and the ecology of hemipterans that occupy spider webs. In addition, students visited an indigenous community in conjunction with an introduction to ethnobiology. Students went to Panama for a look at conservation policy and marine biology at the STRI facilities in Bocas del Toro. Here they received an overview of Panamanian history and conservation policy and spent several days looking at various aspects of marine biology, including plankton, mangroves, coral reefs and marine turtles. Students oversaw a nighttime patrolling activity for leatherback turtles, took a variety of measurements, and relocated the eggs to a nursery. At La Selva, students were introduced to the biology and conservation of herps and conducted their final round of independent projects. This year's La Selva projects looked at a variety of questions, including spider diversity and distribution, ant-plant interactions, edge effects, and leaf cutter ant foraging and orientation. Following the research symposium, students took a brief but intense look at sustainable development and economic alternatives in the Sarapiquí region, visiting projects as varied as banana plantations, an ecotourism lodge, and sustainable extraction of palm seeds.

STUDENTS SPENT SUMMER IMMERSED IN TROPICAL SCIENCE TROPICAL ECOLOGY SUMMER 2002

Coordinators Ethel Villalobos (OTS) and Don Brightsmith (Duke University) provided 21 students the opportunity to study natural history of important plant and animal taxa in tropical habitats within the context of basic ecological and evolutionary principles. Students spent time in the field and in the classroom studying topics ranging from the behavior and physiology of individual organisms to the processes and patterns of communities and ecosystems. The course emphasized intensive fieldwork and visited sites showcasing a great diversity of tropical habitats, each possessing distinctive biotas that demonstrate unique evolutionary settings and ecological adaptations. Three students received scholarships from the OTS Minority Scholars Program.

ETHEL VILLALOBOS



Students designed, conducted, and interpreted independent research projects as part of *Tropical Ecology*.

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UNDERGRADUATES STUDY INDIGENOUS COMMUNITIES IN THE TROPICS

INTRODUCTION TO FIELD ETHNOBIOLOGY SUMMER 2002

Luis Diego Gómez, Las Cruces/Wilson Botanical Garden Director, gave 13 students first-hand experience in the medicinal, ceremonial, esthetic and subsistence use of plants and animals by human communities in Central America. An underlying emphasis was placed on the preservation of natural and cultural resources. Students visited indigenous communities to conduct ethnobiological assessments through interviews with local people. Prior to visiting the communities, students designed an ethnobiological questionnaire, which was then tested and reevaluated. Following visits, participants wrote reports on their findings. In addition, students presented an original research paper on an ethnobiology topic



Seven Ethnobiology students received scholarships from the OTS Minority Scholars Program.

RISHI PARIKH

of their interest. Teaching faculty for the program included representatives from a wide variety of disciplines, such as linguistics, anthropology, botany, traditional dance, environmental policy, and indigenous peoples.

SECONDARY SCHOOL TEACHERS CONDUCT RESEARCH DURING SUMMER BREAK

With funding from the National Science Foundation, OTS implemented the Research Experience for Teachers (RET) program in Costa Rica this summer. Three teachers from the U.S. spent 6 weeks at one of the OTS biological stations where they worked with a researcher to design and conduct tropical biology research. The experience will help teachers as they convey research techniques to their students. 🌿

STUDENT PERSPECTIVE:

Curtis Varnell, Science Department Head, Paris High School, Paris Arkansas



Curtis Varnell is currently on sabbatical from high school teaching working on his Ph.D. in Environmental Dynamics at the University of Arkansas.

The Research Experience for Teachers (RET) provided me with one of the most exciting and educational experiences of my life. I am a career educator, having taught twenty-six years in the public schools of Arkansas. Most of my lives experiences have involved the transmission of accumulated knowledge, passing on the information that our greatest scientists have discovered through their lives of applied research. The RET program provided me the chance to experience science first hand. What an opportunity to be able to participate in the field as an active researcher, carrying out studies in your area of interest. Throw in the opportunity to carry out that study in beautiful Costa Rica and you get an idea of how excited I was to be selected to participate in the program during the summer of 2002.

Through my previous association with the Woodrow Wilson Foundation, I had discovered that the rice paddies near Palo Verde National Park, Costa Rica were contributing huge amounts of phosphorus to the waters entering the park system. I also knew that the park was experiencing astronomical increases in cattail growth within the park. This growth was causing both environmental and ecological changes within the region. I devised a research plan with the assistance of my mentor, Eugenio González (OTS), to determine the correlation between the growth of the cattail and the influx of phosphorus from the rice paddies. Not only were we able to determine that there was a direct correlation between the two, we were able to determine that the cattail were absorbing huge amounts of phosphorus that would otherwise be washing into the Gulf of Nicoya and causing extreme eutrophication problems. The MINAE (Costa Rican EPA) became very interested in the study and its implications. As a result, I was able to devise an ongoing program with them and the University of Costa Rica to apply for grants to continue the research.

The research experience has opened up a world of new doors and opportunities for me. Since returning to the states, we have continued research into viable and economic methods of utilizing the cattail. We are in the process of obtaining a patent that will hopefully help to alleviate the cattail problem in Palo Verde and provide job opportunities for the local people. I will have the privilege of returning to Palo Verde in November with an individual who is interested in developing a business which will make use of the cattail.

Additional advantages of attending the RET program were the opportunity to experience the sights, sounds, and environment of Costa Rica. I observed the volcanic exhaust rising from Arenal Volcano, experienced a mild earthquake in San José, sat in the rainforest and listened to the sounds of life around me at La Selva, and watched the turtles as they waded back into the sea at Tortuguero. I attended Guanacaste Day festivities with my new friends from the research station, watched vaquero's work the cattle herds at the park, and played soccer with the local population. I meet other teachers and professors from across the U.S. and developed contacts and close friends that will last a lifetime.

The research experience allowed me the opportunity to determine the value of allowing our students to be more directly involved in the science process. The importance of accurate data collection, following good science procedures and the scientific method becomes so much more apparent to you when you are the one wading through the mud in 90 degree temperature collecting that data. When the project is your project, you don't mind spending the extra hours and hard work in researching information, learning how to use the equipment, and interpreting the data. I believe we can provide the students with the same attitude if we make them a part of the learning process. I have always realized that there is too much information out there for the teacher to be able to provide the student with every detail of science. We need to teach the student how to learn. My experience through the RET program has shown me that a valuable tool in achieving that is the inquiry and hands-on approach to carrying out science education. 🌿



Conservation Experts Meet

The 2002 Environmental Leaders Forum was hosted by the Center for Environmental Research and Conservation in New York. This annual event included world leaders working in conservation. This year the group addressed the issue of capacity building for conservation. Javier Mateo-Vega, OTS Environmental Science and Policy Coordinator, represented Costa Rica and gave a talk entitled “Advancing decision-maker training in the tropics.” The signing of the Morningside Declaration, which set out an agenda for building and strengthening conservation leadership through international collaboration and local planning, marked the culmination of this year’s international gathering of conservation experts.

Latin American Professionals Join OTS’ Family of Environmentally Aware and Responsible Leaders

PRINCIPIOS ECOLÓGICOS PARA EL DESARROLLO SOSTENIBLE EN AMÉRICA LATINA 02-6

This course, supported by the U.S. Fish & Wildlife Service, is one of the most important capacity-building opportunities for Latin American decision-makers, such as corporate executives, politicians, and non-governmental leaders. These professionals typically do not have formal training in environmental sciences or related fields, but hold great responsibility for the use and management of tropical biodiversity and natural resources. Fifteen professionals from nine countries participated under the coordination of Raúl Solórzano (Director of Renewable Natural Resources of the Ministry of Environment and Energy), Javier Mateo-Vega (OTS) and Leandro Castaño (OTS). The group traveled to reserves in Costa Rica and, for the first time, crossed the border into Panama to meet with representatives from the community of Río Sereno and discuss trans-boundary environmental problems and their proposed solutions. This allowed the group to experience first-hand the social, economic and ecological implications of shared environmental problems that cross political boundaries.

U.S. Policy Makers Gain Understanding of Tropical Issues

INTERDEPENDENCE: ECONOMIC DEVELOPMENT AND ENVIRONMENTAL CONCERNS IN DEVELOPING COUNTRIES 02-8

Since the “U.S. Decision-Makers Course” began fifteen years ago, more than 300 senior staff members from Capitol Hill, other branches of government, NGOs and the private sector have participated in this week-long, field-based course. Coordinators Katrina Brandon (OTS), Andrew Chek (OTS) and Javier Mateo-Vega (OTS) led this year’s course, supported by the U.S. Fish & Wildlife Service. The 20 participants were exposed to lowland rain forest, dry forest, wetlands, cloud forest, as well as several contrasting agricultural, secondary growth and degraded landscapes, all serving to illustrate key issues addressed during this course. Participants discovered the implications of U.S. policy and actions on the environmental well-being of the tropics.

Latin American Park Directors Receive Continuing Education

MANEJO DE AREAS SILVESTRES TROPICALES 02-16

José María Rodríguez (OTS), Leandro Castaño (OTS) and Gerardo Ríos (Ría Celestún Biosphere Reserve, Mexico) coordinated this course for 19 park directors and rangers from nine Latin American countries. With technical and financial support from the U.S. Fish and Wildlife Service, the course spent 7 weeks at 12 parks and reserves in Costa Rica. The managers were trained on a wide range of issues pertinent to their everyday work including ecological principles, conservation biology, wildlife management and monitoring, ecological restoration, protected areas planning, management plan evaluation, community relations, environmental dispute resolution and environmental education.

OTS Environmental Science and Policy Expands Operations to Peru

As one of the 10 most biodiverse nations on the planet, Peru is an obvious attraction to tropical biologists. But in addition to this impressive statistic, there are many others worthy of note—source of the Amazon River, annual deforestation of 200-300 thousand hectares, 10% of global fisheries, immense mineral and hydrocarbon resources, yet upwards of 40% of the population live in poverty. Peru’s natural endowment, its development challenges, and a growing environmental consciousness make it a prime candidate for OTS short courses that present decision-makers with the science behind sustainability.

The OTS Environmental Science and Policy Program, with support from the Hewlett Foundation, will take its “decision-maker” training to Peru. In July 2002, OTS signed an agreement with a broad array of Peruvian institutions, organizations and individuals to cooperate in the implementation of decision-maker training. This network of partners will provide an essential window on the Peruvian context, help with recruiting participants, participate as faculty, and deliver other in-kind support that will allow adaptation of OTS know-how to Peru’s realities. The intent is that in the longer-term, primary responsibility for decision-maker training will be taken over by this network of Peruvian partners. 🌿

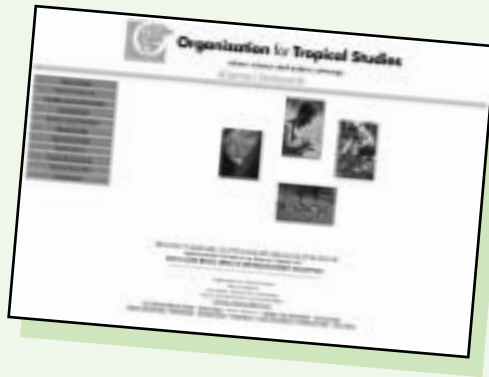


Introducing the OTS Alumni Network at www.ots-alumni.org

This web-based network will provide alumni:

- information on special opportunities, such as fellowships, research experiences, advice from other alumni, research collaborations, researching at our stations, visiting the stations and special events;
- information on getting involved with mentoring programs, serving as course resource personnel, providing advice to other alumni, and volunteering at stations;
- the opportunity to provide address updates and professional information on-line;
- an Alumni Directory to search for classmates and other alumni by profession, professional interest and geographic area.

If you are an alumni, please visit today to check your information for accuracy.



Alumni Set Record for Annual Fund Participation

The Alumni Match Challenge, made by an anonymous alumnus, resulted in records for both the highest alumni participation rate and the total amount given by alumni—495 alumni gave (56% increase) a total of \$53,227 (86% increase). Of these donors to the Annual Fund, 62 alumni were first time donors. The overall alumni participation rate was 20% (while previous participation rates hovered between 13-15%). Thanks to all who participated. Please make it an annual activity! Not only does it provide valuable funds for the organization, but our alumni giving rate is also an important indicator of student satisfaction that is closely watched by other funding sources.

An Interview with Brady Barr



Brady Barr, Tropical Diversity and Conservation 96-10 alumnus, hosts TV series and conducts research in Costa Rica.

How did you become interested in the OTS course?

Brady: I was a grad student at the University of Miami. Dr. Jay Savage inspired me with wonderful tales of the tropics, its biodiversity, and the amazing people of Costa Rica (I ended up marrying a Tica.) Dr. Savage felt that participating in an OTS course would be an invaluable experience. He was right. I came away with a whole new insight into the world where we live.

What was special about the OTS course experience?

Brady: It was an exciting experience to get to see so many different environments in Costa Rica, from rain forests to deciduous dry forests, volcanos to cloud forests! And to be able to experience it with other students with similar interests, from all over the U.S. was very special. It was

fantastic to brainstorm, share ideas, research possibilities, etc. with such a dynamic, diverse group of students. My experience inspired me to learn as much as possible about the tropics and to educate others about its wonders.

How did the course help you in your career?

Brady: I am an educator at heart, being a former high school biology teacher before attending grad school. My OTS course motivated me to finish my Ph.D. so that I could get busy educating others in environmental education. It made me rededicate myself to what I love most, which is teaching others about the environment, the importance of biodiversity, and conservation. One of the first projects I did for National Geographic was to return to La Selva and focus on the Fer de Lance. The film highlighted what an incredibly opportunistic animal it is, yet also a very dangerous one that needs to be respected. Besides my TV work, I am the principal investigator in a National Geographic Society funded research project on crocodile conservation in Costa Rica. The project involves radio tracking translocated

crocodiles to determine whether relocation of nuisance animals is a viable management tool. The project also has a strong educational component with local schools. The children are given a series of lectures on the importance of crocodiles to the local ecosystem, as well as the materials and instruction in making incubators. Each child is given a crocodile egg that he or she incubates, hatches, and cares for throughout the school year. The program culminates when all students release their hatchlings back into the wild to repopulate certain rivers in Costa Rica with crocodiles. This program has been featured in National Geographic magazine and has been incredibly successful in raising awareness for the importance of crocodiles in local riverine systems.

Do you still keep in contact with faculty, classmates?

Brady: Hosting a television series that is seen by more than 120 million people makes me very visible. I constantly get emails, letters and phone calls from old classmates and professors that have seen me on TV.

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Organization for Tropical Studies

40 Years of Education, Research and Conservation in the Tropics



Archie Carr
(famous Tortuguero
turtle researcher)
studies herps
at La Selva in 1978.



Rafael Lucas Rodríguez
(UCR professor
and OTS founder) and
Mildred Mathias
(UCLA professor and
OTS legend) collaborate
teaching a course in 1974.



The "Reading Club" outside the La Selva dining
hall in 1982. Be the first to correctly identify
these three readers and win Jay Savage's
The Amphibians and Reptiles of Costa Rica.
(e-mail christina.cheatham@duke.edu)



Organization for Tropical Studies

Science for the 21st Century March 30-April 5, 2003 Costa Rica

Join us for a week-long program in tropical education, research and conservation as we celebrate our 40th Anniversary. The mix of hands-on learning, presentations by leading environmental researchers and social functions will expand your view of tropical science. The events are open to all. Join us for the entire week or chose the activities that fit your schedule. Register early, space is limited.

EDWARD O. WILSON, one of the founders of OTS and a preeminent biological theorist, will be the Symposium keynote speaker.



Jon Chase/Harvard News Office 1996

Wilson's accomplishments include pioneering work on chemical communication. He also edited *Biodiversity*, which introduced the term and launched worldwide attention to the subject. Two of his 21 books have been awarded Pulitzer prizes. Wilson has received 75 awards, including the U.S. National Medal of Science.

Tropical Biology (Rubber) Boot Camps

March 30 – April 2

Ever wanted to take an OTS course or share your course experience with your family and friends? Here is your chance. No experience necessary. Be prepared to get your rubber boots dirty as you experience the biodiversity of the tropics and discover (or re-discover) how to conduct science in one of the most complex environments on earth. The course will include orientation to the forest and facilities, lectures, group field problems, individual research projects and interaction with notable scientists. Chose from one of the following sites:

Las Cruces Biological Station and Wilson Botanical Garden:

led by bee and butterfly expert Chip Taylor

La Selva Biological Station: led by mammal expert Don Wilson

Palo Verde Biological Station: led by herpetological expert Norm Scott

Celebration Banquet

April 2

The banquet, held in San José, will provide you the chance to see old friends and meet new ones, enjoy the lively stories of OTS days gone by and make plans for future collaborations.

Tropical Science for the 21st Century Scientific Symposium

April 3

Renowned scientists will speak on the future of tropical science and a poster session will feature tropical research. This symposium will be held at the University of Costa Rica (UCR) and followed by a casual cocktail reception.

EDWARD O. WILSON (HARVARD UNIVERSITY) *The Future of Tropical Biology*

PEDRO LEÓN (UNIVERSITY OF COSTA RICA) *Molecular Biology's Impact on Field Ecology*

SALLY HORN (UNIVERSITY OF TENNESSEE)

Understanding Historical Effects: Paleo-ecology of Costa Rica

HARRY GREENE (CORNELL UNIVERSITY) *Organismal Biology*

A. JAMES HICKS (NATIONAL SCIENCE FOUNDATION) *Promoting Diversity in the Sciences*

DEBORAH CLARK (UNIVERSITY OF MISSOURI-ST. LOUIS)

Tropical Tree Demography and Global Change

CALL FOR CONTRIBUTED POSTERS addressing current research, educational program, outreach project or practical application of tropical science for display and review during the Symposium. For complete information visit www.ots.duke.edu. Funding for travel and registration expenses may be available.

Assembly of Delegates Annual Meeting

April 4-5

Join us at UCR for program reports from OTS staff and Board of Director elections.

where science and nature converge

Registration

NAME(S) _____

ADDRESS _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____ COUNTRY _____

EMAIL _____ PHONE _____

San José Hotel Reservations will be made in your name and you will pay directly at the hotel.

Option 1: Villa Tournón

\$58 per single room; \$68 per double room
Rate includes breakfast and taxes.

	Number of rooms
29 March	_____
2 April	_____
3 April	_____
4 April	_____
5 April	_____

Option 2: Radisson Zurqui

\$93 per single room; \$105 per double room
Rate includes breakfast, taxes and transportation to and from the airport.

	Number of rooms
29 March	_____
2 April	_____
3 April	_____
4 April	_____
5 April	_____

Tropical Biology (Rubber) Boot Camps March 30–April 2

Buses depart from San José the morning of March 30 and return April 2.
Prices include transportation, accommodations and meals at the stations and materials.

Las Cruces Biological Station: \$275 per person	\$
La Selva Biological Station: \$275 per person	\$
Palo Verde Biological Station: \$275 per person	\$

Celebration Banquet April 2

Price includes food, drinks and transportation to and from hotel.

\$35 per person	\$
Latin Americans: \$20 per person	\$
<i>free for student poster presenters</i>	

Tropical Science for the 21st Century Scientific Symposium April 3

Price includes registration fee, transportation to and from hotel, lunch, post-symposium reception and materials.

\$100 per person	\$
Latin Americans: \$50 per person	\$
Students: \$25 per person	\$

Assembly of Delegates Annual Meeting April 4–5

Price includes transportation to and from hotel and lunch.

\$70 per person	\$
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TOTAL	\$
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Science for the 21st Century

March 30–April 5, 2003
Costa Rica

Check enclosed

Please charge my:

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NC 27708-0630

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Questions?

christina.cheatham@duke.edu

919-684-5774



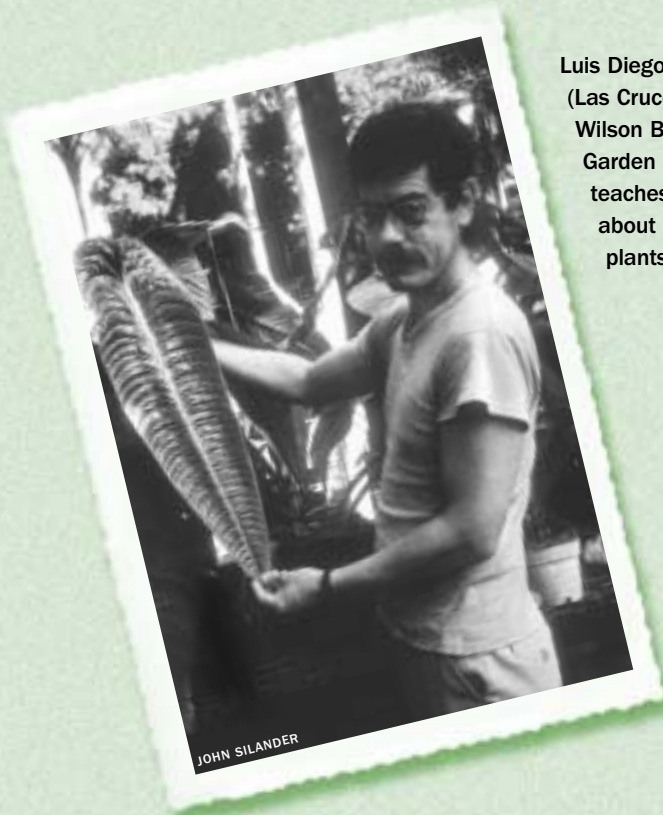
**Organization for
Tropical Studies**



Organization for Tropical Studies



Apparently there was not a “no shirt, no shoes, no service” rule at the La Selva dining hall in 1981. Be the first to correctly identify at least two of these OTSers and win an official OTS Amigo shirt. (e-mail christina.cheatham@duke.edu)



Luis Diego Gómez (Las Cruces and Wilson Botanical Garden Director) teaches students about rare plants in 1988.



Edward O. Wilson (Harvard professor and OTS founder) studies ants at La Selva in 1987.

where science and nature converge



Researchers Collaborate to Investigate Amphibian Declines

by Karen R. Lips, Department of Zoology, Southern Illinois University

Costa Rica has been at the forefront of amphibian decline research ever since Marty Crump first reported the loss of the golden toad of Monteverde in 1988. In 1994, she and Alan Pounds reported the loss of many other amphibian species from Monteverde, perhaps as many as 40% of the original species.

During this time I was conducting my dissertation research on tropical stream frogs in the Zona Protectora Las Tablas on the Panama border. By the time I finished field work in 1994, it was clear that Las Tablas had also experienced massive population declines, losing as many as 50% of the frog species, and over 80% of all individuals. By this time I had initiated research at the Reserva Forestal Fortuna in Chiriquí, Panama (now a STRI field station). In 1996 I observed firsthand a massive die-off of frogs at this site, during which I found 50 dead or dying frogs in a 3-week period. Pathologists determined that these frogs were infected by a type of aquatic fungus that would eventually be described as a new species of chytrid fungus, and the first one pathogenic to vertebrates. This fungus lives in moist and aquatic environments, and has flagellated zoospores which encyst in the epidermis of frogs. Maturing zoospores may become so numerous that they form a thickened skin layer and may contribute to sloughing of the skin. It is not known whether the chytrid

poisons frogs with toxins, or if it suffocates the frogs by blocking the exchange of water or oxygen through the skin. What was of great concern was that this same chytrid fungus was found in dead frogs from the Australian tropics, and that veterinarians and pathologists had not seen this disease before. Since 1998, chytrid fungus has been identified in dead frogs from numerous sites of amphibian decline around the world, and can infect and kill every species of frog tested to date, suggesting that this is a global, emerging infectious disease of amphibians.

Like many areas of conservation biology, amphibian decline research requires rapid responses and collaborative investigations involving many disciplines, researchers, study sites and species. I have been fortunate to be a member of two international, multidisciplinary groups of scientists investigating amphibian population declines in Latin America.

The first group is headed by Jim Collins (OTS 71-3) of Arizona State University and focuses on collaborative field and lab studies that investigate the interaction between amphibians and disease, including research into comparative amphibian ecology, epidemiology, climate change, and host-parasite coevolution. My students and I are currently working on gathering comparative ecological data on the amphibian fauna of Parque Nacional Omar Torrijos in El Copé, Panama. We monitor



In 1996 Karen Lips observed a massive die-off of frogs infected by a new species of chytrid fungus.

terrestrial and aquatic amphibians and reptiles to quantify changes in abundance or diversity, and we study various aspects of amphibian ecology, including population demography, community ecology, reproductive and larval ecology, dispersal patterns, and population genetics. While I occasionally resurvey those incredible sites in the Cordillera de Talamanca, there has been no significant recovery of these amphibian communities, so now I study the diverse and abundant Panamanian herpetofauna.

The second group I am involved in is called R.A.N.A. (*Red de Análisis sobre Anfíbios Neotropicales Amenazadas or Research and Analysis Network for Neotropical Amphibians*). RANA is headed by OTS alumus Bruce Young (and former OTS course coordinator and La Selva Station Director) and myself. We are working with many Latin American scientists in an effort to coordinate research on the causes of amphibian population declines

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What are details of your current position?

Brady: I am National Geographic's reptile expert. I appear on their Explorer TV series, which is seen on NBC. I also host my own series, "Reptile Wild" which is seen on the National Geographic Channel. This same show goes by the name of "The Crocodile Chronicles" everywhere else on the globe. In my show I always work with a local expert or scientist and highlight their amazing research on some of the most fascinating animals on the planet. I am a crocodilian biologist actively working in Costa Rica, so crocodiles really are the focus of the series. I have now studied crocodiles on 5 continents, and am soon to become the first person to ever capture all 23 species in the wild. I need 6 more! 🐊

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throughout the Neotropics. For as bad as the situation is throughout the mid-high elevations of Costa Rica and western Panama, the situation is just as serious in the countries to the north (Mexico, Honduras, Guatemala) and south (Ecuador, Venezuela, Brazil). Our hope is that the collaborations fostered by RANA will lead us more quickly to a comprehensive understanding of declines and disappearances of amphibians in the Neotropics, the center of their diversity. For example, chytrid fungus has turned up in some neotropical areas, promoting collaborations among members of RANA and the amphibian-disease group.

As we begin to make headway in understanding the patterns and processes of amphibian decline in Latin America, I have started collaborating with long-term La Selva researcher Cathy Pringle to understand ecosystem effects of amphibian declines on tropical streams. Unlike temperate zone streams, neotropical streams support a diverse and abundant community of insectivorous frogs and herbivorous tadpoles. If we permanently lose 50% of the species and 80% of the individual amphibians from a site, how will that affect insect, algal, and predator (e.g., snakes) populations? And how will those changes influence nutrient cycling and downstream transport? This is not just idle speculation, but a serious problem with a variety of wide-ranging effects that many tropical biologists still do not fully comprehend. According to Federico Bolaños of the Universidad de Costa Rica, not only have we lost half the amphibian species from a few well-studied sites (e.g., Monteverde, Las Tablas, and Las Alturas), but it is highly likely we have lost a significant portion of the entire montane amphibian fauna of Costa Rica. Consider that next time you visit La Selva and watch the water of the Río Puerto Viejo from frog-less Volcán Barva pass beneath the bridge. And remember – bleach your boots when you leave!

Largest-Flowered Plant in Costa Rica Discovered at La Selva

Mario A. Blanco, *Tropical Plant Systematics* 96-9 alumnus and graduate student at the University of Florida, was at La Selva researching with the support of an OTS fellowship last year when he discovered a huge flower. The plant turned out to be a new species belonging to the Dutchman's Pipe or Birthwort family (Aristolochiaceae), and its flowers



MARIO BLANCO

Although the species is common at La Selva, it appears to flower rarely and is said to be the "birthwort with flowers that look like a pig fetus."

are among the largest of any Neotropical plant. Mario named it *Aristolochia gorgona*, and the description appeared in *Brittonia* (54[1]: 30-39, May 2002), published by the New York Botanical Garden.

The flowers of *Aristolochia gorgona* are about 25 cm across and have a complicated shape. Like other birthworts, they attract carrion flies by producing a putrid smell of rotten meat – fitting for a flower that looks like an animal corpse. The flies are trapped

in a sac-like cavity at the base of the flower for one night. If the flies bring pollen from other flowers, they fertilize the flower. The flies are kept from leaving by specialized hairs in the entrance tube. The anthers open the next morning, covering the flies with pollen, and the hairs drop, letting the flies out.

The species has been collected several times before, but herbarium specimens have been confused with *Aristolochia grandiflora*, a similar species that also has large flowers. In Costa Rica, *A. grandiflora* occurs in the Pacific lowlands, and *A. gorgona* occurs only in the Caribbean lowlands. According to the Missouri Botanical Garden, "because the flowers of both species are very large, structurally complex, and poorly preserved on herbarium specimens, it took an astute orchid specialist, our colleague Mario Blanco, working with living material in the field, to appreciate their differences." 🌿

research funding

For more information, visit www.ots.duke.edu or call (919) 684-5774.

OTS

OTS fellowships are open to graduate students enrolled in degree programs at OTS member institutions and to OTS course alumni. Proposals are reviewed twice a year. Deadlines for receipt of English-language proposals are September 30 and January 15 and for receipt of Spanish-language proposals are September 30 and March 15. Pilot awards for exploratory research are available in amounts up to \$1,500. Research fellowships are intended to support thesis research in tropical biology and related fields and are available in amounts up to \$5,000. Proposals for research at OTS biological stations are encouraged and will receive priority. However, outstanding proposals for research at other locations will be considered.

OTS-STRI

OTS and the Smithsonian Tropical Research Institute (STRI) invite proposals for comparative research at OTS facilities in Costa Rica and STRI facilities in Panama. This program is funded by the Andrew W. Mellon Foundation to promote exploratory, comparative research in tropical biology. Fellowships are available to graduate students and post-doctoral investigators of any nationality from any institution and have limits of \$3,000 and \$6,000, respectively. Proposals may be submitted in any sub-discipline of tropical biology and may include research at OTS and STRI sites. Investigators that have data from a STRI site (e.g., Barro Colorado Island) may apply for funds to conduct research at one of the OTS sites (e.g., La Selva Biological Station) and vice versa.

The Las Cruces Biological Station and Wilson Botanical Garden are unique in many ways. The world-class botanical collection is one of the most important in all of the tropics. The combination of old-growth forests, pastures, regenerating forests and agriculture make the station an outstanding location to study the ecosystems and biodiversity of the tropics. Now add to that the proximity to the Coto Brus Reservation.

Many students at Las Cruces visit the reservation and learn about ethnobiology from members of the Guaymi Tribe.

Students Interact with Indigenous People of Costa Rica

by Yana Reid, student, Haskell Indian Nations University

This summer I was afforded the very fortunate opportunity to participate in the OTS *Ethnobiology* course. Growing up on one of the most poverty stricken Indian reservations in the United States and knowing my communities own struggles

granddaughter, implying that it was time for the girl to marry. Childhood marriage for girls this age, as we later discovered, is common practice.

I also met a Guaymi man named Luis. At 54, he and his family lived in a home with floors made out of packed dirt, the walls made from split wood and the roof made from panels of tin. As our discussion continued, it came to bear that Luis was keenly aware of the poverty stricken nature in which he and his family were living. Yet, here I was, with my new digital camera asking to take his picture. The irony of that moment has forever changed my perception of the world and my place within it.

I am developing and soliciting funding for a project that will assist the Guaymi people in maintaining food resources in times of marginal subsistence and to address some of the vitamin gaps of their daily diet. I hope to have this project funded and underway the summer of 2003.

The *Ethnobiology* course helped solidify my long-term educational goals. After graduation I will attend graduate school in systematic ichthyology and continue my research on the freshwater fish of Costa Rica. I also intend for my relationship with Costa Rica and the Guaymi people to be both long and reciprocal. 🌿



on a personal basis, I relished the chance to interact with the Indigenous tribes of Costa Rica. The experience proved to be unequivocal and to far exceed any of my expectations.

As part of this course, we conducted interviews with people from the Guaymi Tribe on the Coto Brus Reservation. After a thirty-minute drive from Las Cruces and a 3-mile hike through the picturesque reserve, we came to our first interviewee. Priscilla, wearing a traditional large collar Guaymi dress, appeared to be approximately 50 years old and spoke in broken Spanish. She proceeded to sincerely share with us that, although she was unaware of her own age, they needed to find a boyfriend for her 12 year old

Geographic Information System (GIS) Lab Creates On-line Database

by Antonio Trabucco, La Selva GIS Laboratory Manager

Since its inauguration in 1991, the La Selva GIS lab has developed a diverse geographical database to serve the research and education needs at the station. Initially, the GIS lab used classic field survey methods to gather positional information for features on the ground and then stored them in geographically referenced databases (called “coverages” or “layers” in GIS parlance). Instrumental in this process was the La Selva 50 x 100 m rectangular grid system of 3,096 marked grid tubes surveyed to decimeter accuracy, spanning the entire reserve. Measuring range and bearing to these tubes can thus spatially reference any feature in the field. Although handheld GPS systems are now widely available and inexpensive, they do not yet penetrate La Selva’s dense forest canopy and the grid system remains an indispensable research and education tool. Field survey methods allowed the GIS lab to build a variety of resources useful for research and education, including detailed coverages of streams, rivers, trails, land-use history and soil taxonomy of the La Selva reserve, as well as layers useful for station administration, such as a research plots coverage and the La Selva site plan.

More recently, as remote sensing data have become cheaper and richer in detail, the lab has integrated the use of imagery from instruments flown in aircraft and satellites to map physical features, such as topography, and to

measure vegetation characteristics, such as canopy height and forest biomass on the ground. Some of this imagery was purchased, but other data were acquired as a byproduct of remote sensing research conducted at the station. La Selva is an attractive site for remote sensing research projects, because the existing GIS coverages, other station data and grid system, can be used to ‘ground-truth’ remote sensing results. The new remote sensing information can then be overlain on the coverages that La Selva’s GIS lab has assembled over the years.

The GIS lab published several datasets on the internet (<http://www.ots.ac.cr/en/laselva/gis.shtml>) to make them easily accessible to students, scientists,

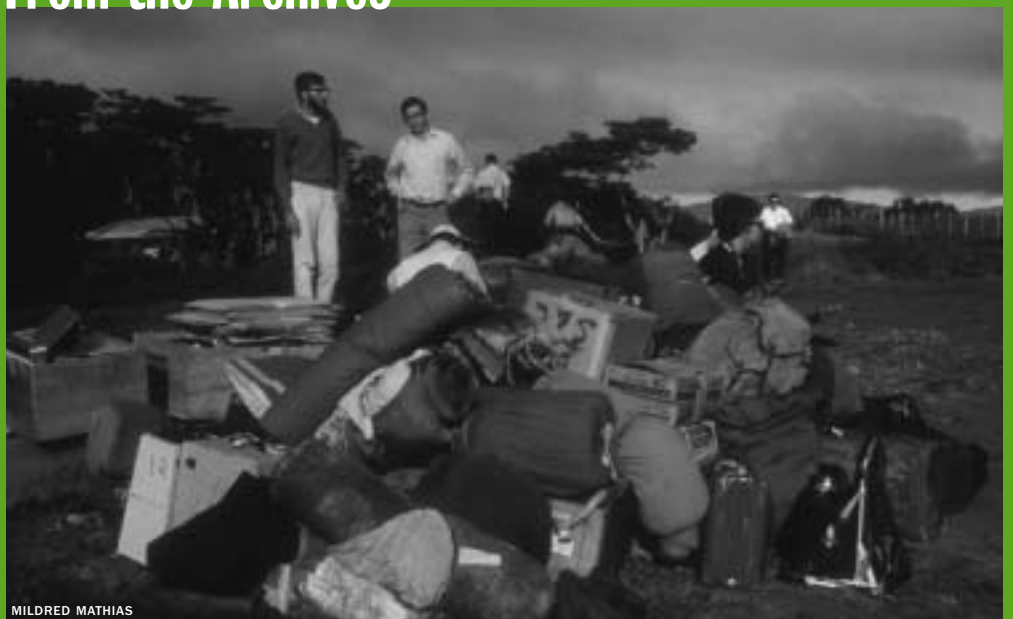
conservation organizations and the general public throughout the world. The accessibility of the data for La Selva reserve and surrounding region will multiply the usefulness of this information.

The core of the GIS web page is the geographical database for La Selva, which includes all the coverages and images available at the station. In addition, the GIS lab is developing a database for the surrounding region, which includes Braulio Carrillo National Park, the Río Sarapiquí watershed and the proposed La Selva - San Juan Biological Corridor, which would link La Selva to Tortuguero National Park, the Barro Colorado Reserve in northern Costa Rica and the Indio Maíz reserve in southern Nicaragua. 🌿



The altitudinal transect from La Selva to Volcán Barva (2906 m) through the Braulio Carrillo National Park attracts many research projects that compare tropical biology along an elevational gradient of nearly 3,000 meters.

From the Archives



MILDRED MATHIAS

The 1967-6 Tropical Biology course students (and their luggage) wait at the San Vito airport for their ride.

Marsh Restoration Vital to More Than 100 Migratory Bird Species

by Eugenio González, Palo Verde Director and Javier Mateo-Vega, Environmental Science and Policy Coordinator

Each year, approximately 330 bird species of the 852 identified in the United States migrate to Mesoamerica, South America and the Caribbean. Of these, it is estimated that 106 stage, feed and/or winter in aquatic ecosystems, including critical areas such as the lower Tempisque River Basin in Costa Rica, home to the Palo Verde marsh and an extensive complex of estuarine, shallow fresh- and brackish-water wetlands.

Although migratory birds continue to visit this area each year, primarily between October and April, there has been a marked decline observed in the number of species and individuals that stage, nest or winter in the lower river basin, including Palo Verde. There is strong evidence to suggest that habitat degradation by natural- and human-induced events in both breeding and wintering grounds, has been the main culprit for this decrease in resident and migratory avian populations. OTS will help resolve this problem in the Palo Verde marsh by implementing a series of restoration and complementary actions.

The Palo Verde marsh was declared a Ramsar Site in 1991 for, among other things, hosting on a regular basis a population of



Part of the 50 ha restored Palo Verde marsh with open water areas intermixed with floating vegetation and sedge beds.

over 20,000 waterfowl, including many migratory species, such as black-bellied whistling duck (*Dendrocygna autumnalis*), blue-winged teal (*Anas discors*), American wigeon (*Anas americana*), northern shoveler (*Anas clypeata*) and ring-necked duck (*Aythya collaris*). In 1993, due to significant changes in the ecological characteristics of the area, Palo Verde was added to Ramsar's Montreux Record; a list of wetlands that require special attention to safeguard their conservation. The most evident change was the

massive invasion of aquatic plant species that began in 1980, after the area was declared a national park and cattle grazing was eliminated. This pasturing activity is believed to have kept aquatic plants in check. Although cattle were allowed back in the marsh in 1991, the numbers were not sufficient to combat the encroaching plant species and revert the wetland to its previous state. In 1997, OTS hosted a workshop with national and international experts to discuss the management options for Palo Verde, which set the stage for a 1998 study conducted by a team of specialists from the Ramsar Convention Bureau. The conclusions of the workshop and the study clearly indicated the critical need for restoration actions in the Palo Verde marsh in order to re-establish and protect migratory and resident waterfowl and their habitats.

Aggressive invasive plant species such as cattail (*Typha domingensis*) have almost entirely closed open-water areas, which has significantly reduced migratory bird visitation. Between October 2000 and April 2001, the period when migratory birds winter, stage and feed in Palo Verde, species and numbers appeared to be at an all time low. In response to this

problem, OTS secured funding in late 2001 to restore approximately 10% (i.e., 50 ha) of the wetland, by mechanically crushing the cattail with paddle wheels on tractors and allowing grazing in the area to reduce emergent vegetation.

This highly effective solution was originally designed and tested by researchers from the Regional Wildlife Management Program at Universidad Nacional. Although the results are preliminary, in February 2002 alone, a total of 7,500 black-bellied whistling ducks and 8,500 blue-winged teal were recorded in the marsh. These numbers fall short of the 35,000 and 25,000 records noted for each species, respectively, in 1979, yet indicate a marked increase from the 2000-2001 migration counts. In order to continue, expand and implement a long-term approach to this successful initiative, OTS, MINAE and collaborators will work on developing a restoration and management plan for the marsh. The primary activities in this plan are a detailed topographic survey, mechanical crushing and disking of invasive aquatic plants, water level monitoring and management, and waterfowl monitoring. 🌱

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JONATHAN GILES,
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- The National Science Foundation's Field Stations and Marine Laboratories Program awarded \$115,000 for infrastructure improvements to the Palo Verde Biological Station, including new staff housing, a board walk into the Palo Verde marsh, researcher housing and shade houses.
- The National Science Foundation awarded a grant of \$39,395 for a pilot program focusing on Research Experiences for Teachers at the Palo Verde and La Selva Biological Stations.
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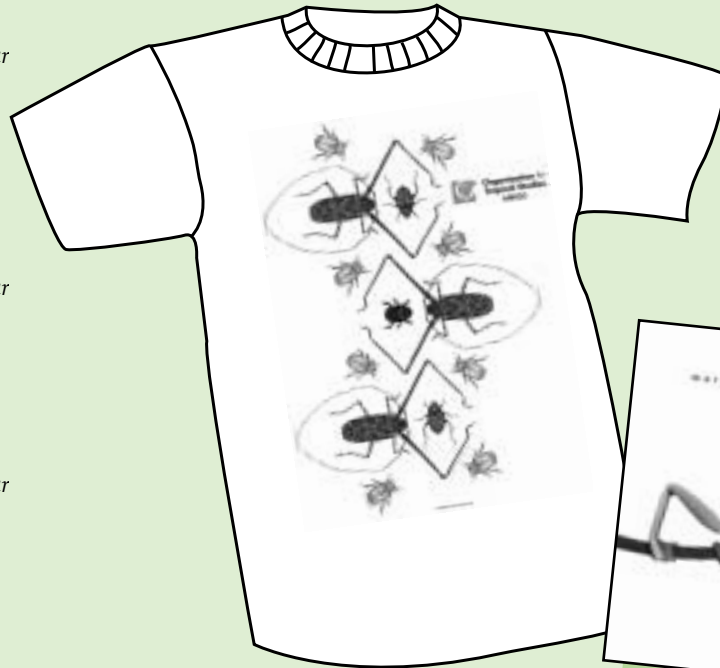
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