



Organization for Tropical Studies

Annual Report Fiscal Year 2000

1 July 1999 - 30 June 2000

*Dedicated to providing leadership in education, research and
the responsible use of natural resources in the tropics.*

The Organization for Tropical Studies is a nonprofit consortium of 64 universities and research institutions from the U.S., Costa Rica, Perú, México, South Africa, Canada and Australia. OTS was established in 1963 to provide leadership in education, research and the responsible use of natural resources in the tropics. To address this mission, OTS provides graduate, undergraduate and professional training, facilitates research, participates in tropical forest conservation, maintains three biological stations in Costa Rica and conducts environmental education programs.

Message from the President and CEO

This report summarizes our activities for Fiscal Year 2000 (1 July 1999 - 30 June 2000). During this time, we made excellent progress in education, research and conservation in the tropics.

We trained graduate students in our intensive, hands-on field courses and we reached undergraduate students through our semester and summer programs. We provided professional education to people already established in their careers, including secondary school teachers, park managers, business people and government officials. All of these courses provided one-of-a-kind training opportunities for nearly 500 students and professionals to develop skills necessary for leadership roles.



Pete Carmichael

As part of our research facilitation efforts, we assisted 400 researchers pursuing 184 projects at the OTS biological stations in Costa Rica and awarded \$88,000 in research fellowships to 134 researchers. More than 155 scientific publications were published during the year based on work at our stations. Our role in research, from flora and fauna inventories to global change projects, is vital to increasing the world's knowledge of tropical ecosystems and the relation to the global environment.

The OTS biological stations hosted nearly 20,000 visitors last year, including students, researchers and natural history visitors. These stations continue to serve as premier sites in the tropics for people from all over the world to experience and study the biodiversity of the tropics.

I am proud of the progress that the dedicated staff, volunteers and supporters of this 38-year-old consortium made possible this year. I am also excited about the possibilities the future holds as we improve our offerings, expand programs and form partnerships to meet the needs of students, researchers and the global community.

A handwritten signature in cursive script that reads "Gary Hartshorn".

Table of Contents

2	Board of Directors
2	Consortium Member Institutions and Assembly of Delegates
3	Message from the President and CEO
4	Board of Visitors
4	Offices
5	Education
11	Research
18	Environmental Policy
22	Environmental Education
23	Biological Stations
26	Development
28	Finances

Board of Visitors

Karen Arras
Environmentalist
Joan Slatkin Barton
Environmentalist
Michelle Cloud
Environmentalist
Ida Cortés de Gamboa
Environmentalist
Chris Darby
@Stake
Russell Faucett
Barrington Partners

John Foster
Harbor Advisory Group
Peter Gilmore
Dole Foods, S.A.
Thomas Hendrickson
Triangle Environmental
Frank Hovore
Frank Hovore & Associates
Ileana Jiménez de Terán
Environmentalist
Robert Kramer
Kramer Green Zuckerman
& Kahn

Thomas Lovejoy
World Bank
Alan McGowan
The Gene Media Forum
Marigold Murray de Genis
Hacienda Cachí
Gordon Orians
U. Washington (emeritus)
Arthur Pappas
A.M. Pappas & Associates
Jonathan Powers
IBM (retired)

Tamra Raven
Environmentalist
Carlos Rodríguez E.
CATIE
Rodolfo Silva
Former Costa Rican
Ambassador to the U.S.
Don Stone
Duke U. (emeritus)
Christiana Tyson
Environmentalist
Richard White
Duke U.

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<www.ots.ac.cr>

Las Cruces Biological Station and Wilson Botanical Garden

San Vito de Coto Brus, Costa Rica
Phone: (506) 773-4004
Fax: (506) 773-3665
E-mail: lcruces@hortus.ots.ac.cr

La Selva Biological Station

Puerto Viejo de Sarapiquí, Heredia, Costa Rica
Phone: (506) 766-6565
Fax: (506) 766-6535
E-mail: laselva@sloth.ots.ac.cr

Palo Verde Biological Station

Palo Verde National Park, Guanacaste, Costa Rica
Phone: (506) 661-4714
Fax: (506) 661-4712
E-mail: pverde@ots.ac.cr

Education

In fiscal year 2000, OTS offered seven graduate courses, an undergraduate semester abroad program, an undergraduate summer program, an increased number of research fellowships for graduate students, an opportunity in East Africa, an institute for secondary school science teachers, and a workshop for faculty and staff. In addition, OTS began a comprehensive review of the graduate program.

Graduate Education

Tropical Biology: An Ecological Approach (99-3)

The OTS Fundamentals course, geared toward students in the early stages of graduate study, was an intensive field experience in Costa Rica that provided exposure to diverse tropical ecosystems and training in research methods. The curriculum included lectures, field problems, presentations, independent research projects and discussion groups at the following field sites: Las Cruces, Las Alturas, Cerro de la Muerte, La Selva, Cabo Blanco, Palo Verde, Santa Rosa, Tivives and Monteverde. Among the outstanding cast of resource people were seasoned OTS regulars such as Craig Guyer (Auburn U.), Mo Donnelly (Florida International U.) and Rob Colwell (U. Connecticut). The course also benefited from several first-time resource faculty, including Francisco Ornelas (Instituto de Ecología, Xalapa, México), Nora Underwood (U. California-Davis) and Richard Boyd (Cornell U.).



Deedra McClearn

As part of *Tropical Biology 99-3*, students examine ectoparasites on bats and demonstrate the OTS trademark of learning by doing.

Coordinator: Deedra McClearn (OTS)
Co-coordinator: Brad Boyle (OTS)
Teaching Assistant: Víctor Carmona (OTS)

Students:

Vanessa Beauchamp (Arizona State U.)
Nancy Beecher (Indiana U.)
Scott Boback (Auburn U.)
Diana Bocanegra (Purdue U.)
Sarah Bray (U. Florida)
Elizabeth Burroughs (Duke U.)
Justin Calabrese (Arizona State U.)
Bridgett Chapin (U. Kansas)
Stacy Crevello de Sánchez (Louisiana State U.)
Scott Fitzgerald (Oregon State U.)
Michael Gavin (U. Connecticut)
Christy McCain (U. Kansas)
Jorge Mena-Alí (U. Costa Rica)
Kimberly Powers (U. Arizona)
Douglas Scofield (U. Miami)
Jon Seal (Louisiana State U.)
Jennifer Sorensen (U. Utah)
Chadwick Tillberg (U. Colorado)
Cristina Ugarte (Florida International U.)
Timothy Vargo (Purdue U.)
Richard Wallace (U. Florida)
James Watling (Florida International U.)

Agroecología Tropical (99-7)

This interdisciplinary course analyzed agricultural systems from an ecological perspective and targeted graduate students and professionals in agronomy. The course took place in four different sites across the Costa Rican landscape, organized into four academic modules. In the first module, carried out on the slopes of Irazú Volcano in Cartago, students analyzed the agricultural parcel as an ecological unit, an exercise that required teamwork among professionals in both the biological and agricultural sciences. The second module at La Selva focused on the interactions and comparisons between agro-ecosystems and natural forest ecosystems. The third module took place in San Carlos (“Zona Norte”) where students participated in group field exercises dealing with the interactions between local agricultural communities and their environment. Students were required to synthesize their new-found knowledge through independent research projects in the fourth module, based at Las Cruces. One of the outstanding features of this course was its ability to transcend cultural and disciplinary boundaries. Biologists, agronomists, social scientists, North Americans and Latin Americans worked together, learned from each other and acquired experience in field research and professional presentation of results.

Carlos Zapata works on an independent research project near Las Cruces as part of the *Agroecología Tropical* course.



Silvia Alvarado

Coordinator: Mickie Swisher (U. Florida)
Co-coordinator: José Manuel Mora (U. Costa Rica)
Teaching Assistant: Vernon Arias (U. Costa Rica)

Students:
 Chelina Batista (STRI, Panamá)
 Olivier Castro (U. Costa Rica)

Juan Manuel Cruz (México)
 Juan Carlos Linares (Colombia)
 Jorge Lotero (Colombia)
 Tomás Moreno (STRI, Panamá)
 Tracey Osborne (U. Florida)
 Leodan Portes (México)

Emma Lucía Rivera (Colombia)
 Angélica Ruíz (México)
 Michelle Schroeder (U. Miami)
 Roberto Tinoco (Honduras)
 Christian Villalobos (UNA, Costa Rica)
 Carlos Zapata (Ecuador)

Tropical Biodiversity (99-10)

This three-week intensive field course introduced students, who ranged from undergraduate to full professor with interests equally varied, to tropical ecosystems and conservation issues in Costa Rica. The course began at Palo Verde where Katie Sieving (U. Florida) and Mike McCoy (UNA, Costa Rica) were outstanding resource people. In addition to the typical group field problems, this course had a lively discussion of various conservation issues such as the relation between fragmentation and scale, stewardship of protected areas and the importance of defining objectives for national parks. At La Selva, John Vandermeer (U. Michigan) was a powerhouse in the forest with hours of stories and an encyclopedic knowledge of tropical biodiversity. Together with Ivette Perfecto (U. Michigan), they gave lectures and led discussions and field problems on agroforestry, tropical community ecology and the relation of bananas to ecological and socioeconomic conditions.

Coordinator: Peter Sherman (U. Arizona)
Co-coordinator: Elizabeth Stockwell (Dalhousie U.)

Students:
 Mariell Anzelone (Rutgers U.)
 Rebecca L. Brown (U. North Carolina)
 Justin F. Epting (U. California-Irvine)

Pamela I. Erickson (U. Connecticut)
 Holly H. Ganz (U. California-Davis)
 Kenneth T. Gioeli (U. Florida)
 Dina L. Grayson (Michigan State U.)
 Kirsten N. Hines (Florida International U.)
 Harold W. Luihle (Brookdale Community)
 Margaret M. Minzer (Southern Illinois U.)

Ravic P. Nijbroek (U. Florida)
 Rodolfo G. Quirós (OTS)
 Daniel Ritman (Sidney Sussex College)
 Sarah A. Schaefer (U. Michigan)
 Theresa Thomas (Michigan State U.)
 Emily S. Weeks (U. Massachusetts-Amherst)
 Robin M. Wilburn (Purdue U.)

Ecología da Floresta Amazônica (99-12)

This course, conducted jointly by OTS and INPA (Instituto Nacional de Pesquisas Amazônia), the BDFFP (Biological Dynamics of Forest Fragments Project, Smithsonian Institution) and UNICAMP (Universidade Estadual de Campinas), was conducted in Portuguese and focused on the ecology of flooded and *terra firme* forests in the region around Manaus, Brazil. The students visited a wide range of forest types, ranging from sandy soil low forests to typical primary rainforest, to black and white-water flooded forests. More than 20 visiting faculty participated in the course, including Rodolfo Dirzo (UNAM), Deborah Clark (U. Missouri-St. Louis) and William Eberhard (U. Costa Rica).

Coordinator: Mike Hopkins (INPA)
Co-coordinator: Eduardo Venticinqu (INPA/BDFFP)
Teaching Assistant: Selvino Neckel (INPA)

Students:
 Adalberto José dos Santos (UNICAMP, Brasil)
 Alexandra dos Santos Pires (UFRJ, Brasil)
 Ana Cristina S. Andrade (INPA, Brasil)
 Ana Carolina Carnaval (U. Chicago)
 Bernal R. Herrera (U. Costa Rica)
 Daniela Vidalenc (INPA, Brasil)
 Helida Ferreira da Cunha (U. Fed. De Goiás, Brasil)
 Jorge Iván S. Botero (INPA, Colombia)

José Miguel Pérez (Museo de Historia Natural, Perú)
 Karina Silva (UNICAMP, Brasil)
 Luciano Naka (INPA, Brasil)
 Anália D. de Souza (FUA, Brasil)
 Gracimar P. de Araújo (FUA, Brasil)
 Mara Patrícia Pais (USP, Brasil)
 Marcelo Fragomeni Simon (UnB, Brasil)
 Mariana Guenther Soares (UFRJ, Brasil)
 Marisol Ayala V. (Corp.de Conserv., Ecuador)
 Milson dos Anjos Batista (USP, Brasil)
 Sidnei de Melo Dantas (INPA, Brasil)
 Yolanda Cachú Pavón (UNAM, México)

Tropical Biology: An Ecological Approach (00-1)

The second English-language tropical biology course in fiscal year 2000 included stays at Monteverde, Cabo Blanco, Palo Verde, La Selva, Cerro de la Muerte, Corcovado and Las Cruces in Costa Rica. Students were introduced to the fundamentals of field tropical ecology, such as identifying plant families, life zones of Costa Rica, and neotropical birds and mammals, as well as participated in workshops, discussion groups, field problems and independent projects. Faculty-led field projects included water quality and vertical stratification of epiphyte-dwelling microarthropods. Individual field problems included insect herbivory on *Myriocarpa longipes*, leaf litter herpetofauna survey and ethnobotanical use of common plants.

Coordinator: Deedra McClearn (OTS)
Co-coordinator: J.B. Heiser (Cornell U.)
Teaching Assistant: Corine Vriesendorp (Michigan State U.)

Students:

Elizabeth Anderson (U. Georgia)
Todd Aschenbach (U. Kansas)
Kristin Bakkegard (Auburn U.)

Adam Boyko (Purdue U.)
Eli Bridge (U. Minnesota)
Heather Brown (Indiana U.)
Richard Fredrickson (Arizona State U.)
Emilie Grossman (Oregon State U.)
Charles Gunnels (U. Florida)
Amanda Hale (U. Miami)
Dana Hawley (Cornell U.)
Patrick Herron (Tulane U.)
Derek Hitchcock (U. Colorado)

Jeff Lemieux (Oregon State U.)
Jeremy Lichstein (North Carolina State U.)
Sarah McCarthy (Rice U.)
Wendy Schelsky (U. Illinois)
Laura Schreeg (Michigan State U.)
Makiri Sei (U. Massachusetts-Amherst)
Benjamin Strauss (U. Washington)
John Tooker (U. Illinois)
Katey Walter (U. California-Davis)

Ecología Tropical y Conservación (00-2)

Twenty-two students (selected from more than 100 candidates) took part in this course in Costa Rica focusing on research methods in tropical ecology and a field unit on conservation biology. The course began in Parrita with basic field problems in a palm plantation, where students learned about research design and how to manage statistical programs and computer software. At the next two sites (Rara Avis and Cerro de la Muerte), students had orientation walks and faculty-led field problems before commencing independent research projects. After a stop at Punta Morales marine station for report writing, the course continued on to OTS field stations Palo Verde and La Selva, where increased emphasis was placed on independent research. At both of these sites, dry forest and wet forest seminars were held with individual presentations designed to prepare students for professional meetings. Additional enrichment was provided by 21 invited professors.

Coordinators: Alejandro Farji (U. Comahue, Argentina)
Gilbert Barrantes (U. Costa Rica)
Teaching Assistant: Mariana Altrichter (U. Nacional, Argentina)

Students:

Luisa Fernanda Arnedo (Pontificia U. Javeriana, Colombia)
Elisa Bonaccorso (U. Simón Bolívar, Venezuela)
Carlos Daniel Cadena (U. los Andes, Colombia)
Raquel Cervantes (U. Nacional de Córdoba, Argentina)
Adolfo Correa (U. Nacional, Medellín, Colombia)
Carlos Espinoza (U. Nacional, Costa Rica)
Juan Manuel Guayasamín (Pontificia U. Católica, Ecuador)
Milena Gramacho (U. Brasilia)
José Manuel Guzmán (Instituto de Ecología y Sistemática, Cuba)
María de los Angeles La Torre (U. Agraria La Molina, Perú)

Horacio Lorini (U. Mayor de San Andrés, Bolivia)
Ana Carolina Monmany (U. Tucumán, Argentina)
Narel Paniagua (Herbario Nacional de Bolivia)
Leonardo Paolini (U. Tucumán, Argentina)
Estela María Quintero (U. Antioquia, Colombia)
Mariana Romero (U. Nacional Autónoma de México)
Miguel Angel Salinas (U. Michoacán de San Nicolás de Hidalgo, México)
Tatiana Santander (Ecuador)
Jorge Alberto Solórzano (U. Sao Paulo, Brasil)
Oscar Valverde (Fundación Corredor Biológico Talamanca-Caribe, Costa Rica)
Richard Villalobos (Autoridad Nacional del Ambiente/Proyecto BIODARIEN, Panamá)
Ju-Lin Weng (U. Costa Rica)

Tropical Biology (00-1) and Ecología Tropical y Conservación (00-2) Collaboration

The annual collaboration between the Spanish and English language Fundamentals courses introduced students to potential research collaborators from across Latin America and the U.S. as well as illustrated some of the challenges and rewards inherent in working across languages and backgrounds. Mixed teams from the two courses carried out six field projects at La Selva. Student presentations were original, witty and entertaining, using various strategies for communicating their results to an unevenly bilingual audience. *Ecología Tropical y Conservación* won the soccer game this year, evening up the series after last year's loss to the English course team.

Ecosistemas Amazónicos (00-13)

The course was offered in conjunction with ACEER (Amazon Center for Environmental Education and Research) and UNAP (Universidad Nacional de la Amazonía Peruana) in the region surrounding Iquitos, Perú. Twenty-two graduate students and natural resource managers from 10 countries were selected from an applicant pool of 98. Resource people included professors from Brasil, U.S., Colombia and Perú. Following student presentations and statistics workshops at Explorama Inn, the course worked for 10 days in the flooded forests of ExplorNapó Camp. The dry land of ACEER was next, where students took part in orientation walks, faculty-led group projects and independent projects. The ACEER canopy walkway provided the setting for several very successful group and independent projects, including the morphology and demography of *Tropidurus* lizards, the vertical distribution of epiphytes and predation on *Ostecephalus* tadpoles.

Co-Coordinator: Alejandro Farji (U. de Comahue, Argentina)
Bette Loiselle (U. Missouri-St. Louis)

Teaching Assistant: Wendy Tori (Perú) and Sandra Correa (Colombia)

Students:

Natacha Chacoff Zavala (Laboratorio de Investigaciones Ecológicas de los Yungas, Argentina)
Gabriela Demergasso (U. Nacional de Córdoba, Argentina)
Ana Sallenave (Museo Argentino de Ciencias “Bernardino Rivadavia”, Argentina)
Marina Faria Do Amaral (U. Brasilia)
Flavia dos Santos Pinto (Instituto de Pesquisa Ambiental da Amazonia, Brasil)
Luis H. Chasqui Velasco (U. del Valle, Colombia)
María A. Galindo González (Fundación OMACHA, Colombia)
Joel Tupac Otero Ospina (U. Puerto Rico)
Jorge Luis Montero Muñoz (U. Nacional, Costa Rica)
Lucrecia Arellano Gámez (Instituto de Ecología, México)
Alonso Irán Sánchez Hernández (U. Veracruzana, México)
Jorge Iván Uribe Juárez (U. Missouri-St. Louis)
Ruby Zambrano Muñoz (STRI, Panamá)
Adriana Bravo Ordoñez (U. Nacional Agraria La Molina, Perú)
Alessandro Catenazzi Giannoni (Asociación Peruana para la Conservación)
Rosario Del Aguila Chávez (U. Nacional de la Amazonía Peruana)
Roosevelt García Villacorta (U. Nacional de la Amazonía Peruana)
Carlos Rivera González (U. Nacional de la Amazonía Peruana)
Liz Eliana Vergara Vargas (U. Nacional de San Antonio Abad del Cusco, Perú)
Tamara Heartsill Scalley, (U. Puerto Rico)
Catherine Hamlin (Ohio U.)
Berónica Camaripano Venero (U. Venezuela)



Nora Bynum

In the second annual offering of the *Ecosistemas Amazónicos* course, a diverse group of students was immersed in the flooded and upland forests of the western Amazon region of Perú.

Collaborations

Tropical Biology Association

Patricia Townsend (U. Florida) participated in the month-long Tropical Biology Association course at the Elsamere Field Studies Centre, Lake Naivasha, Kenya. The course covered a range of topics in ecology, evolutionary biology, conservation biology, experimental design and field techniques. It provided Patricia and students from Europe and Africa with the opportunity to share ideas and learn from each other through activities such as guided walks, identification workshops, lectures, seminars and research projects.

Environmental Science Institute

Funded by the National Science Foundation and administered by the Woodrow Wilson National Fellowship Foundation Leadership Program for Teachers (WWNFF-LPT), this course taught middle and high school science teachers how events in the tropics are related to local and global environmental issues. In addition, the course demonstrated techniques in inquiry-based science education. Participants were divided into three groups and circulated among the three OTS sites where they received orientation walks and conducted and presented field projects. Back at home, participants conducted institutes modeled on their Costa Rican course in order to disseminate what they learned about inquiry-based teaching and global environmental change to their colleagues.

Coordinators:

Tom Langen (Clarkson U.)
James Wetterer (Florida Atlantic U.)
Philippe Hensel (OTS)
Ted Stiles (Rutgers U.)
Lisa Forman Novemsky (WWNFF)
David Silverberg (WWNFF)
James Cole (WWNFF)
William Lawrence (WWNFF)

Abelardo Correa (New York, NY)
Jamilia Daulatzai (Walnut, CA)
Rick Dutra (Wichita, KS)
Evelyn Erickson (New York, NY)
Raylene Gerber (Milford, OH)
Diana Getty (Grand Prairie, TX)
Mary Giambruno (Decatur, GA)
Peg Goldman (Bennington, VT)
Harold Walter Groeneboer (Dallas, TX)
Myra Halpin (Pittsboro, NC)
Barbara Hawes (Haiku, HI)
Kathryn Jouvenat (Colorado Springs, CO)
Ruth Juhant (Lockppport, IL)
Christa Lundberg (Colorado Springs, CO)
Gerald Mark Lyke (Anchorage, AK)
Rebecca Marks (Grand Rapids, MI)
Patty Marshall (Salyersville, KY)
G. Dale Mast (Golden, CO)
Suzanne McClung (Alexandria, VA)
April McCrae (Smyrna, DE)
Doreen Rojas Medlin (Albany, GA)

William Mills (Delmar, DE)
Maria Mora (Ponce, PR)
Mary Moreira (Minneapolis, MN)
Noel Nelson (Anchorage, AK)
Michael Novemsky (Maplewood, NJ)
Amy O'Donnell (New York, NY)
Carol Bloom Paine (Baton Rouge, LA)
Melanie Phelps (Colorado Springs, CO)
Sarah Abigail Poe (Norwich, KS)
Anna Belle Pyle (Dunwoody, GA)
Rachelle Rapp-Dickerson (Milford, OH)
Melanie Revere (Morgantown, NC)
Carol Richlin (Culver City, CA)
Tracy Runyon (Inez, KY)
Kermit Simons (Cordova, TN)
Roger Warner (Dacula, GA)
Stacy Weaver (Edinburg, TX)
Helen Joyce Webb (Monument, CO)
James Whelan (Baton Rouge, LA)
Jherimeccee Womack (Riverdale, GA)
Steven Zbaida (Elmhurst, NY)

Participants:

Nancy Edwards Allen (Knightdale, NC)
Patricia Argetsinger (Wichita, KS)
Alisa Benjamin (Stone Mountain, GA)
Amy Biasucci (Maplewood, NJ)
Leslie Brinson (Durham, NC)
Shannon Bunch (Lake Forest, CA)
Kenneth W. Carlson (Roselle, IL)
Mildred Chamblee (McDonough, GA)
Ingrid Chlup (Santa Ana, CA)
Marsha Jo Colvin (Leander, KY)

Undergraduate Education

The Undergraduate Study Abroad Program (USAP), offered in collaboration with Duke University, focused on the OTS method of field-based, experiential learning in Costa Rica. The semester program consisted of four courses, *Fundamentals of Tropical Biology*, *Field Research in Tropical Biology*, *Environmental Science and Policy of the Tropics* and *Spanish Language and Latin American Culture*. The summer course was *Tropical Ecology*.

Fall Semester 1999

Karin Gastreich began her tenure as Director of USAP with the start of the fiscal year. In this semester, the teaching staff included full-time resident professors Erika Deinert and Philippe Hensel, as well as half-time resident professors, Ana Villegas and Evan Notman. The students spent three weeks in Santa Ana studying Spanish and living with host families, followed by a three-week stay in Las Cruces, one week in Cerro de la Muerte, two weeks in Palo Verde and four weeks in La Selva. Rafael Mata (U. Costa Rica), Monika Springer (U. Costa Rica), Chris Ivey (Florida International U.), Beth Braker (Occidental College) and Jack Longino (Evergreen State College) joined the group as visiting faculty, gave lectures and led field projects on soil conservation, the use of aquatic insects in assessing water quality, differential nectar production in ant-plants and army-ant ecology and behavior. During the semester, students conducted two short-term independent projects and one long-term independent project.

Students:

Elizabeth Brallier (Rhodes College)

Clare Carron (Duke U.)

Alexandra Echandi (Cornell U.)

Jaimie Gleisner (Western Washington U.)

Philip Grabowski (Michigan State U.)

Sabrina Grossman (College of William & Mary)

Katherine Hobbs (Duke U.)

Pauline Hopper (Tulane U.)

Sarah Johnson (Washington U.)

Eric Kao (Duke U.)

Shawn Kefauver (Rhodes College)

Sherri Kies (Bowdoin College)

David Laclergue (Carleton College)

Jessica Lin (U. North Carolina-Chapel Hill)

José Mandojana (Emory U.)

Jill Maynard (Oregon State U.)

Sarah McGill (Duke U.)

Elizabeth Roeder (Grinnell College)

Kimberly Tice (Bowdoin College)

Rashmi Tiwari (Grinnell College)

Julia Trippel (Swarthmore College)

Malinda Walter (Grinnell College)

Douglas Woodhams (Michigan State U.)

Adam Yablonski (Washington and Lee U.)

Spring Semester 2000

This semester's program was joined by new faculty member Mahmood Sasa and teaching assistant Vivian Méndez (U. Costa Rica). Students spent three intensive weeks in San Rafael de Heredia, living with host families, taking Spanish classes in the morning and attending afternoon lectures or field trips related to one of the other three program courses. Students then traveled to Palo Verde for an introduction to tropical entomology, mangrove ecology and management and rice production in the Tempisque river basin with guest appearances by Joan Strassmann and David Queller (Rice U.) and Jorge Jiménez (OTS). Students then traveled to Las Cruces where they worked with Evan Notman (Miami U. of Ohio) on plant biology. At Cerro de la Muerte, Ken Foster (Purdue U.) accompanied the group and led a unit on environmental economics, with a focus on the economics of small farms. At La Selva, students received a thorough introduction to the dynamics of a lowland tropical rain forest, including a field exercise on plant demography. At the end of the semester, students presented final results from a variety of field investigations.

Students:

Susan Bacon (College of William & Mary)

Kristen Bell (Oberlin College)

Jillian Brennan (Amherst College)

Ryan Burns (U. North Carolina-Chapel Hill)

Ashley Burt (Duke U.)

Patrick Carney (Washington U.)

Matthew Davis (Swarthmore)

Lindsey Fransen (Wesleyan U.)

Katharine Hand (Tufts U.)

David Hof (U. Arizona)

Suzanne Hunt (Penn State U.)

Malia Knezek (Duke U.)

Jessica Koederitz (Louisiana State U.)

Beth Lawrence (Cornell U.)

Erin Loggins (Rice U.)

Erin Marnocha (Washington U.)

Holly Martinson (Duke U.)

Lydi Morgan (Amherst College)

Daniel Nelson (Duke U.)

Sarah Ott (Baldwin Wallace College)

Steven Passafaro (Drew U.)

Anne Patterson (Drew U.)

Katharine Smith (Duke U.)

Hannah Stutzman (Bryn Mawr College)

Laura Weiland (Ursinus College)



Dan Nelson

The Semester Abroad Program introduced students to ecologically-contrasting sites and the vast and unique biodiversity of the tropics, such as this lungless salamander that breathes through its skin.

Tropical Ecology - Summer 2000

The second offering of this four-week summer course for undergraduates included lectures, field trips and orientation walks, faculty-led projects and independent research projects. At Las Cruces, the garden walk provided the students with an overview of plant diversity and a plant lab introduced them to basic botanical concepts and pollination strategies. Discussions included talks on forest fragmentation and agricultural use of the land, and one faculty-led project focused on the relationship between habitat complexity and species diversity. At Palo Verde, the course emphasized conservation, management and forest regeneration. The class project dealt with natural regeneration in dry forests and the group project focused on the importance of remnant trees as a nucleus for natural regeneration in dry forest habitats. At La Selva, students worked on a variety of independent projects such as nest predation, aposematic coloration in snakes, predation in butterflies, the effect of flower mites on the host plant, the activity patterns of leaf-cutter ants and drip tip function.

Coordinators: Ethel Villalobos (OTS)
Don Brightsmith (Duke U.)

Students:

Joel K. Abraham (Howard U.)
Christopher R. Alexander (Wabash College)
Anne E. Berenbom (U. Pennsylvania)
Douglas M. Brinkley (Duke U.)
Jennie L. Burns (U. Utah)
Susan P. Canny (Williams College)
Jamie L. Crawford (Tufts U.)
Heather A. Fox (U. Wisconsin-Madison)
Jessica A. Gigot (Middlebury College)
Kellie M. Hawkins (Howard U.)
JuuYun J. Hsieh (U. California-Berkeley)
Laurie J. Klotz (Duke U.)
Bonmyong Lee (Duke U.)
Katie R. Lillard (Haskell Indian Nations U.)
Priya G. Mulgaokar (Duke U.)
Byron J. Norelius (U. Richmond)
Yana R. Reid (Haskell Indian Nations U.)
Meredith K. Warren (Duke U.)



Ethel Villalobos

Kellie Hawkins was one of five students who received a fellowship funded by the National Science Foundation that diversified the *Tropical Ecology* course to include more students from groups under-represented in the sciences and economically disadvantaged students.

Plant Systematics and Field Identification

The first OTS faculty/staff professional development workshop was held with funding provided by the Andrew W. Mellon Foundation. The sixteen participants traveled from La Selva to Monteverde to Palo Verde to study plant families over a wide range of ecosystems. The workshop was led by Brad Boyle, coordinator of the 1998 and 2000 *Tropical Plant Systematics* graduate course, and La Selva's Orlando Vargas. Participants included the director and faculty of USAP, station directors and staff and the Academic Director. Through this workshop, staff improved their ability to contribute to the Education Program in the area of plant identification. An extra benefit of the course was the opportunity to interact and form closer ties with OTS colleagues from different parts of the organization.

Comprehensive Review of the Graduate Program

With funding from the Andrew W. Mellon Foundation, a comprehensive review of the graduate program began in fiscal year 2000. The Committee, chaired by Deborah Clark (U. Missouri-St. Louis), will evaluate the current slate of OTS graduate courses, survey the perceived needs of member institutions with regard to graduate courses, survey the impact of OTS course experiences on alumni and evaluate the current administrative structure of OTS.

Research

OTS Fellowships and Awards

In fiscal year 2000, OTS awarded fellowships totaling \$89,018 to 67 U.S. and Latin American graduate students who were either enrolled in degree programs at OTS member institutions or who were OTS course alumni. This included \$69,000 for 26 research fellowships, \$2,000 for two pilot awards and \$17,313 for 39 post-course awards.

ANDREW W. MELLON GRADUATE FELLOWSHIP AWARDS

- Mario A Blanco (U. Costa Rica), Desarrollo de las contorsiones en el tallo en "Escaleras de mono" (*Bauhinia* spp.), Palo Verde y La Selva
- Berónica Camaripano, Estudio florístico, fisionómico y dendrológico del bosque inundable del Río Sipapo inferior, Estado Amazonas, Venezuela
- Catherine Cardelús (U. Connecticut), Distribution and abundance of vascular epiphytes in tropical wet forests: a multiscale approach
- Elena Castillo (U. Costa Rica), Análisis poblacional de especies silvestres del género *Bactris* (Arecaceae), de la Estación Biológica La Selva en Costa Rica, utilizando métodos moleculares
- Federico Chinchilla (Instituto de Ecología UNAM, México), Efecto de la fragmentación en la comunidad de mamíferos terrestres y la depredación de semillas en un bosque húmedo tropical, Monteverde
- Miguel Cifuentes (North Carolina State U.), A comparison of light regimes under human-made multi-species tropical ecosystems, and their effect on plant growth
- Marie de la Fuente (U. Colorado), Patterns of plant resource allocation to plant defenses: the impacts on the intervention of the plant, the environment, and natural insect herbivores
- Brian Dunphy (U. Georgia), A phylogeographic analysis of two dry forest tree species in Central America
- Emilie Grossmann (Oregon State U.), Leaf litter decomposition at La Selva
- Daniel Henk (Duke U.), Systematics of *Septobasidium*
- Patrick Herron (Tulane U.), Mycorrhizae in the epiphytic pteridophytes of La Selva
- Meera Iyer (Michigan State U.), The effects of spatial and temporal heterogeneity in light and soil resources on seedling survival and growth in a tropical dry forest
- Kathleen Kay (U. Washington), Reproductive isolation in neotropical *Costus*
- Jeff Lemieux (Oregon State U.), Leaf litter decomposition at La Selva
- Sarah McCarthy (Rice U.), Herbivory differences in two color variants of *Triolena hirsuta* and the effect on their population structure
- Jorge Meña-Alí (U. Costa Rica), Temporal variation in stigma receptivity, pollen viability, and nectar production in *Bauhinia unguolata*
- Michelle Schroeder (U. Miami), Tropical intercrop yield responses to arbuscular mycorrhizas, phosphorous, and density
- Douglas Scofield (U. Miami), Microsite specialization of *Capparis* species
- Benjamin Strauss (U. Washington), Effect of leaf shingling on herbivory rates
- Dorset Trapnell (U. Georgia), Hierarchical genetic structure of the epiphytic orchid, *Laelia rubescens*
- Liz Veregara, Efecto de densidad y borde sobre la remoción de semillas de *Iriartea deltoidea*
- Corine Vriesendorp (Michigan State U.), Arrival and survival in a tropical forest: the role of a life history trade-off in maintaining plant diversity
- Katey Walter (U. California-Davis), The role of substrate in epiphytic nutrition in tropical Costa Rican forests
- Catherine Woodward (U. Wisconsin), Reproductive success of tropical trees in small forest fragments: analysis of gene flow, fruit set and inbreeding depression
- Rakan Zahawi (U. Illinois-Urbana-Champaign), Island biogeography theory and restoration: the role of tree islands as regeneration foci in the rehabilitation of abandoned pastures in Honduras

CONSERVATION BIOLOGY FELLOWSHIP AWARDS

- Rebecca Brown (U. North Carolina), Plant dispersal patterns in an abandoned pasture at Las Cruces
- Justin Calabrese (Arizona State U.), Tangled's web: A model system for studying Higher-Order Interactions
- Amanda Hale (U. Miami), Metapopulation approach to understanding the effects of sociality on Black-breasted Wood Quail population dynamics and persistence
- Terry Krueger (U. Miami), Song as indicator of parasitism and as a predictor of male mating success in Cherrie's tanager (*Ramphocelus costaricensis*)
- Eli Sarnat (U. California-Berkeley), Taxonomic survey of disturbed habitat Formicidae fauna at La Selva Biological Station
- Brian Spitzer (U. California-Davis), Local adaptation in the scale insects *Aissetia coffeae* (Homoptera: Coccidae)

PEACE FROGS AWARDS FOR AMPHIBIAN RESEARCH

Scott Boback (Auburn U.), Dietary patterns in a Neotropical lowland rainforest hyliid assemblage

Kay Bradfield (James Cook U.), Using the measurement of asymmetry as a technique for identifying amphibian populations at increased risk of decline

Bridgett Chapin (U. Kansas), Community composition and frog utilization of the rolled-leaf habitat in wetlands associated with tropical dry and wet forest

Tibisay Escalona (U. Missouri-St. Louis), Nest site selection and reproductive success of a threatened river turtle (*Podocnemis unifilis*, Testudines: Pelmedusidae), in the lower Caura River, Venezuela

Jennifer Sorensen (U. Utah), Ectoparasite and endoparasite loads in the Palo Verde Ctenosaur (*Ctenosaura similis*)

Cristina Ugarte (Florida International U.), Anuran communities of the Palo Verde marsh: Initial steps to a long-term study

James Watling (Florida International U.), A survey of the hyliid frogs at the La Selva research swamp

GLAXO PHARMACEUTICAL LATIN AMERICAN GRADUATE FELLOWSHIP AWARDS

Lucrecia Arellano Gamez, Diversidad de escarabajos coprofagos (Scarabeidae: Scarabacinae), en un mosaico de habitats en la Amazonia Peruana

Adriana Brazo Ordonez, Tamano y estructura de la poblacion de Lobos de Río, a lo largo del Río Heath dentro del Parque Nacional Bhauja Sonene, Departamento de Madre de Diós

Alessandro Castenazzi, Patrones de forrajeo en el microhylido myrmecophago *Hamtophyne boliviana*

Mauricio Castillo (Instituto Tecnológico de Costa Rica), Creación y validación de un mapa de cobertura vegetal en Sarapiquí, heredia, usando imágenes de los satélites LandSat 5 o LandSat 7, La Selva

Luis Chasqui Velasco, Caracterización de la ictiofauna en la zona baja del Río Miriti-Paraná, Amazonia Colombiana

Marina Faria Do Amaral, Sistema reproductivo de *Cyanocorax cristatellus* (Corvidae)

Alejandra Galindo González, Existe interacción por recurso pesquero entre delfines y hombres?

José Antonio Guzmán (Instituto Tecnológico de Costa Rica), Comparación de modelos digitales de elevación para la preparación y validación de mapas de ríos y quebradas en la Estación Biológica La Selva, Sarapiquí

Cathy Hamlin, Diversidad de escarabajos coprofagos (Scarabeidae: Scarabacinae), en un mosaico de habitats en la Amazonía Peruana

Ivan Jiménez (U. Missouri-St. Louis), Habituation and quantification of the diet of Great Curassows at La Selva Biological Station

Catherine Numa (U. Nacional de Colombia), Patrones espaciales de defecación de *Cebus capucinus* y *Alouatta palliata* y su relación con la efectividad en la dispersión de semillas, Palo Verde

Jorge Uribe, Patrones geográficos de diversidad y recambio en la comunidad de aves de sotobosque: disectando el componente de Beta Diversidad a lo largo de un gradiente

Elisabeth Wehnke (UNAM, México), Patrones espaciales de defecación de *Cebus capucinus* y *Alouatta palliata* y su relación con la efectividad en la dispersión de semillas, Palo Verde

DONALD AND BEVERLY STONE ENDOWMENT

Stone Fellowships

Scott Fitzgerald (Oregon State U.), Bat and ectoparasite diversity along an elevational gradient in a Costa Rican cloud forest

Derek Johnson (U. Miami), A test of metapopulation incidence function parameters: a comparison of predictions from census data and from experimental data

Chadwick Tillberg (U. Colorado), Behavior and ecology of *Coprophaneaus morenoi* at carrion

Emily P. Foster Fellowships

Susana Patricia Bravo (Museo Argentino de Ciencias Naturales), Evaluación de los efectos de la dispersión de semillas producida por los monos aulladores, La Selva

Patricia Brennan (Cornell U.), Ecology of exclusive male parental care and mating system of the Great Tinamou (*Tinamus major*), in a tropical wet forest

Kimberly Powers (U. Arizona), Sociality in pseudoscorpions at La Selva

Erin Vogel (SUNY-Stony Brook), The ecological basis of coalition formation in white-faced capuchin monkeys (*Cebus capucinus*) in a Costa Rican dry forest

Ju lin Weng (U. Costa Rica), Robo de fragancias almacenadas en las tibias de los machos euglosinoas (Apidae: Euglossinae), La Selva

Rexford Daubenmire Fellowships

Stacy Crevello de Sanchez (Louisiana State U.), Traditional herbal medicines in Sarapiquí, La Selva, Costa Rica: An ethnobotanical analysis

Bradley Dickey (U. Kentucky), Antlion foraging: the effect of predator-induced injury on prey behavior and predator foraging decisions

David and Deborah Clark Fellowships

Johel Chavez (U. Costa Rica), Localización de hormigas guerreras por las aves que las siguen, La Selva

Dole Foods Fellowships

Holly Ganz (U. California-Davis), The relationship between productivity and species diversity in bromeliad communities

Elizabeth Anderson (U. Georgia), A survey of neotropical bird communities found near army ant swarms

Mariellé Anzelone (Rutgers U.), Mutualisms between members of the Bromeliaceae and their aquatic invertebrate fauna

Daniel Ritman (U. Sidney Sussex), Ant diversity in old-growth forest, secondary forest, and agricultural plots at La Selva Biological Station

Timothy Vargo (Purdue U.), Nesting behavior and sociality in the Azure-hooded Jay (*Cyanolyca cucullata*)

Research at OTS Biological Stations

Project Title / Principal Investigator(s) / Researcher(s) and Assistant(s)

LAS CRUCES BIOLOGICAL STATION

- All taxon diversity survey of Diptera (INBio) / Giar-Ann Kung (Los Angeles County Museum of Natural History) / *Melanie Wang*
- Anatomía y morfología de agaricales (Fungi) / Yaxelis Mendoza (Smithsonian Tropical Research Institute, Panamá)
- Asentamientos humanos y transformación del medio ambiente en las tierras altas del Cantón de Coto Brus / Mauren Sanchez, Sergio Chávez (U. Costa Rica) / *Oscar Fonseca*
- Avian population censusing / James Zook (Independent)
- Avian seed dispersal in abandoned pastures / Frederick Werner (Cornell U.) / *Audrey Sandí, Ronald Murillo*
- Biodiversity assessment: Distribution of biodiversity in forest patches and the agricultural landscape / Gretchen Daily (Stanford U.)
- Biodiversity conservation in fragmented landscapes / Gretchen Daily (Stanford U.), Paul Ehrlich (Stanford U.)
- Bird species diversity of forested and agricultural land in Costa Rica / Catherine Lindell (Michigan State U.) / *Walter Chomentowsky*
- Butterfly diversity in forest fragments / Gretchen Daily (Stanford U.)
- Butterfly diversity in native and agricultural habitats / Claire Devine (Stanford U.) / *David Goehring, Forrest Fleischman, Regina Sanderson, Sarah Girshick (Stanford U.), Thomas Davis, Ellyn Bush, Jesús Ilama*
- Chemical defenses in Costa Rican birds / Todd Capson (STRI), Luis Diego Gómez
- Coleoptera and pollination of Cyclanthaceae / Luis Diego Gómez (OTS)
- Collections of Costa Rican fungi, particularly Pleurotaceae and nematofagous fungi / R. Greg Thorn (U. Wyoming)
- Conservation of biodiversity in tropical moist forest fragments / Paul Ehrlich (Stanford U.)
- Countryside biogeography: The future of biodiversity in human dominated landscapes / Gretchen Daily (Stanford U.)
- Cycad toxins and *Aulacoscelis costaricensis* (Coleoptera) / Luis Diego Gómez (OTS)
- Determinación del estado de *Eleuterodactylus vocator* en Panamá / César Augusto (Instituto Smithsonian de Investigaciones Tropicales), Adam Jaramillo
- Diversity of Cassidine beetles of Las Cruces Biological Station (Coleoptera: Chrisomelidae: Cassidinae) / Caroline Chaboo (American Museum of Natural History & Cornell U.) / *Randy Figueroa, Jason Figueroa*
- Ecology and phylogeny of the inbreeding bark beetles (Scolytidae), breeding in leaf stalks, pods and seeds in Costa Rica / Lawrence Kirkendall (U. Bergen, Norway)
- Environmental values and attitudes in natural resources management / Caroline Stem (Cornell U.)
- Establishment of tropical tree seedlings in abandoned pastures / Satya Rhodes-Conway (U. California-Irvine)
- Flora Costaricensis: Droseraceae / Luis Diego Gómez (OTS)
- Flora Costaricensis: Orobanchaceae / Luis Diego Gómez (OTS), William C. Burger (Field Museum-Chicago)
- Grasshoppers of Costa Rica and Panamá / C. Hugh Rowell (U. de Basil)
- Host plants of Chrysomelidae / R. Wills Flowers (Florida A&M U.)
- Hydrology of Laguna Gamboa / David Barth (Rutgers U.)
- Influence of forest-pasture edges on lizards and frogs of Fila Cruces / Martin Schlaepfer (Cornell U.) / *Anne Soccia (Cornell U.), Randy Figueroa*
- Inventario de insectos de Costa Rica (INBio): Baridine weevils / Jens Prena (Institute für Okologie, Germany)
- Investigación arqueológica en Las Cruces / Mauren Sanchez, Patricia Rojas (U. Costa Rica) / *Oscar Fonseca, Sergio Chavez (U. Costa Rica)*
- Mating systems of wood-rotting and litter-decomposing macromycetes / Ronald Petersen (U. Tennessee) / *Juan Luis Mata*
- Microscopic wood fungi / Liuba Kisimova-Horovitz (U. Tübingen, Germany)
- Mycorrhizae in epiphytic and other Costa Rican ferns / Luis Diego Gómez (OTS)
- Mycota of Costa Rica / Luis Diego Gómez (OTS)
- Ontogeny of *Septobasidium* fungi (Basidiomycetes) parasitic on scale insects (Homoptera) / L. Kisimova-Horovitz (U. Tübingen, Germany), Luis Diego Gómez (OTS)
- Paleoecology of the Las Cruces area / Sally Horn (U. Tennessee), Robert L. Sanford (U. Denver) / *Kevin Anchukaitis, Lisa Kennedy, Martin Arfard, Rachel Clement, Chris Malone*
- Phosphorus release and conservation in the litter of a modified Costa Rica slash-mulch bean production system (frijol tapado) / Isidor Ruderfer (U. Georgia)
- Plant dispersal patterns in an abandoned pasture at Las Cruces / Rebecca Brown (U. North Carolina)
- Plantas medicinales de Coto Brus / Rolf Erdmann (Independent)
- Pre-estudio para una liquenoflora del Jardín Botánico Wilson / Robert Lucking (U. Bayreuth, Germany)
- Resupinate Basidiomycetes of Costa Rica / Luis Diego Gómez (OTS), Liuba Kisimova-Horovitz (U. Tübingen, Germany)
- Revision of the genus *Melaltoncha* (Diptera: Phoridae) / Giar-Ann Kung (Los Angeles County Museum of Natural History) / *Melanie Wang*
- Role of micorhizas in pasture recolonization by a tropical tree / Laura Aldrich-Wolfe (Cornell U.)
- Science-community partnerships in Latin America / Brian Lutz (Arizona State U.)
- Song as an indicator of blood parasitism and a predictor of male mating success in the Cherrie's tanager (*Ramphocelus costaricensis*) / Terry Krueger (U. Miami) / *Pilar Cisneros, Audrey Sandí, Oscar Amador, Lisa Bakanskas*
- Systematics and biodiversity of Curculionidae / Robert Anderson (Canadian Museum of Nature)
- Systematics and biology of Braconidae (Hymenoptera) / Nina Zitani (U. Wyoming)
- Systematics of *Septobasidium* / Daniel Henk (Duke U.)
- The effects of forest fragmentation on forest insectivorous birds through changes in the insect community / Cagan Sekercioglu (Stanford U.) / *Deniz Aygen, David Goehring, Forrest Fleischman, Regina Sanderson (Stanford U.), Thomas Davis, Randy Figueroa, Audrey Sandí*
- Tropical intercrop responses to arbuscular mycorrhizas, phosphorus availability and density / Michelle Schroeder (U. Miami)
- Vegetation mapping / Dan Vreundenhill, Carmen Linarte (Proyecto Banco Mundial CCAD)
- Vegetation mapping / Wilberth Herrera (Proyecto Banco Mundial CCAD)
- Water beetles (*Coleoptera*) of Costa Rica / Rob Roughley (U. Manitoba, Canada), William Shephard (U. California-Berkeley)

LA SELVA BIOLOGICAL STATION

A chronological survey of the diversities of generalist versus specialist parasitic wasps (Hymenoptera: Ichneumonoidea) / Beth Shapiro (U. Georgia)

A comparison of light regimes under human-made multi-species tropical ecosystems and their effect on plant growth / Miguel Cifuentes (North Carolina State U.)

A regional land-use map for La Selva and vicinity / Mauricio Castillo (ITCR)

A study of bird communities surrounding army ant swarms / Elizabeth Anderson (U. Georgia)

A survey of the hylid frogs at the La Selva research swamp / James Watling (Florida International U.)

A test of metapopulation incidence function parameters: comparison of predictions from census data and experimental data / Derek Johnson (U. Miami) / Carolyn Adams (Brandeis U.), Axel Burglund (volunteer), Vide Ohlin (volunteer), Simone Korten (volunteer), Arnaud Raulin (volunteer), Yuichiro Suzuki (volunteer)

Agalychnis tree frog ecology / Michael McCay (U. California-Berkeley)

Allometry in *Paraponera clavata* / Michael Breed (U. Colorado)

Alternatives for reforestation with native trees in Sarapiquí / Junior Torres (U. Costa Rica)

An examination of the attraction and initiation phases of courtship behavior of the amblypygids of La Selva (Arachnida; Amblypygi) / Eileen Hebets (U. Arizona)

An investigation of structural forest floor heterogeneity and light availability as mechanisms for maintaining the diversity of tree species at La Selva / Laura Schreeg (Michigan State U.)

Ant diversity in old-growth forest, secondary forest and agricultural plots at La Selva Biological Station / Daniel Ritman (Cambridge U., United Kingdom)

Antiparasitoid mechanisms in tropical lepidopteran larvae / Lee Dyer (Mesa State College), Grant Gentry (Mesa State College), Craig Dodson (Mesa State College) / Walt Kelley (Mesa State College), Amy Schaefer (Mesa State College), Justin Searcy (Mesa State College), Monique Hoch (U. Wisconsin), Jennifer Burley (volunteer), John Fleet (volunteer), Linda Brookover (Earthwatch), David Fenili (Earthwatch), Sue Fenili (Earthwatch), Jennifer Glueck Andi (Earthwatch), Maggie Honig (Earthwatch), Robert Honig (Earthwatch), Toshimi Iwamura (Earthwatch), Melisa Shah (Earthwatch), Peter Uttal (Earthwatch), John Williams (Earthwatch), Kin Wilson (Earthwatch), Carol Wolff (Earthwatch), Cindy Woodhead (Earthwatch)

Ants in secondary forest / Robert Dunn (U. Connecticut)

Army ants and their guests / Carl Rettenmeyer (U. Connecticut) / Marc Jones (U. Connecticut)

Arthropod diversity in a lowland tropical rain forest (ALAS) / Robert Colwell (U. Connecticut), Jack Longino (Evergreen State College), Henry Hespeneheide (U. California-Los Angeles) / Valerie Behan-Pelletier (Agriculture Canada), Gitanjali Bodner (U. Arizona), Donald Davis (Smithsonian Tropical Research Institute, Panama), Glavis Edwards (Division of Plant Industry, Gainesville), Eric M. Fisher (California Dept. Food & Agriculture), Lawrence Kirkendall (U. Bergen), Giar Ann Kung (Los Angeles County Museum of Natural History), Evert Lindquist (Agriculture Canada), Piotr Naskrecki (U. Connecticut), Wojciech Niedbata (A. Mickiewicz U., Poland), Ronald Ochoa (USDA-ARS Systematic Entomology Laboratory), Ziemowit Olszanowski (A. Mickiewicz U., Poland), Jerry Powell (U. California-Berkeley), Jens Prena (U. Rostock), Charles Staines (Smithsonian Institution), Susan Staines (Smithsonian Institution), David Wagner (U. Connecticut), Robert Westerdoy (INBio), Danilo Brenes (OTS), Nelci Oconotrillo (OTS), Maylin Paniagua (OTS), Ronald Vargas (OTS)

Arthropods in banana and other tropical monocultures under different pesticide regimes / Robert Matlock (OTS) / Brian Schwartz (OTS), Michael Dietze (OTS)

Bee pollination of trees in tropical wet forests / Rainer Thiele (U. Tübingen, Germany) / Bjorn Rogell (volunteer), Jasper Oestlund (volunteer)

Behavior of male paper wasps (*Mischocyttarus collarellus*) at the natal nest, with studies on natural history and genetic structure of colonies and populations / Elizabeth Smith (U. Kansas)

Behavioral flexibility in *Pachycondyla apicalis* / Amy Savage (Evergreen State College)

Biodiversity of aquatic fungi / Carol Shearer (U. Illinois-Champaign-Urbana) / Jennifer Anderson (U. Illinois-Champaign-Urbana), Rebecca Wulffer (U. Illinois-Champaign-Urbana)

Biodiversity's data base / Francisco Font Castell (U. Barcelona, Spain)

Biogenic volatile organic compounds emissions from tropical forests / Alex Guenther (National Center for Atmospheric Research), Chris Geron (U.S. EPA)

Biology of euglossine bees / Ju-Ling Weng (U. Costa Rica)

Carbon dating of La Selva trees / Martin Worbes (U. Göttingen, Germany), Deborah Clark (U. Missouri-St. Louis) / Esther Naumer (U. Göttingen, Germany)

Changes in resource acquisition by plants of different life forms as a function of their age and stature (EPIHUERTOS) / Jack Ewel (USDA Forest Service), Nalini Nadkarni (Evergreen State College) / J. Alexandra Reich (OTS), Karen Carney (Stanford U.), Mark Merwin (Evergreen State College), Steve Rentmeester (Evergreen State College), Keirith Snyder (U. Arizona)

Changes in the La Selva bat fauna over 30 years - feasibility study / Anne Brooke (U. Tennessee)

***Morpho peleides* (Nymphalidae: Morphinae)**
is one of Lee Dyer, Grant Gentry and Craig Dodson's study subjects in their project on antiparasitoid mechanisms in larvae.



Lee Dyer

- Changes in the diet of Neotropical migratory birds during pre-migratory and migratory periods / John Prather (U. Arkansas)
- Community composition and frog utilization of the rolled-leaf habitat in wetlands associated with tropical dry and wet forest / Bridgett Chapin (U. Kansas)
- Comparison of losses to herbivores by monocot and dicot leaves / Peter J. Grubb (U. Cambridge, United Kingdom)
- Contributions to the knowledge about secondary forest and its diversity / Helga Rodríguez (Yale)
- Contributions to the validation of the use of dung beetles (Coleoptera: Scarabaeinae) and butterflies (Lepidoptera: Nymphalidae) as indicators in rapid evaluations of biodiversity / Naikoa Aguilar (CATIE)
- Countryside biogeography of birds in Costa Rica / Gretchen Daily (Stanford U.) / Jim Zook (Freelance)
- Current and future carbon budgets for tropical rain forest: a cross-scale analysis (CARBONO) / Steve Oberbauer (Florida International U.), David Clark (U. Missouri-St. Louis), Deborah Clark (U. Missouri-St. Louis), Edzo Veldkamp (U. Göttingen, Germany) / Joseph O' Brien (Florida International U.), Hank Loescher (U. Florida), Luitgard Schwendenmann (U. Göttingen, Germany), Greg Starr (Florida International U.), Anja Becker (U. Göttingen, Germany), Matthew Schroeder (Florida International U.), Leonel Campos (OTS), William Brenes (OTS), Danilo Villegas (OTS), Jenny Roessner (U. Göttingen, Germany), Markus Boehm (U. Göttingen, Germany)
- Demography and ecophysiology of regeneration of tropical rain forest trees (TREES) / David Clark (U. Missouri-St. Louis), Deborah Clark (U. Missouri-St. Louis)
- Demography and ecology of the invasive shrub *Clidemia hirta* / Saara DeWalt (Louisiana State U.) / Garret DeWalt (volunteer)
- Diet shift in leaf-hopper tending by ants and wasps / James Wetterer (Florida Atlantic U.)
- Dietary patterns in a Neotropical lowland rainforest hylid assemblage / Scott Boback (Auburn U.) / Scott Fitzgerald (Oregon State U.)
- Differential seedling survivorship: a search for community level patterns / Corine Vriesendorp (Michigan State U.)
- Dispersal of seeds of three commercial arboreal species, disseminated by vertebrates in fragmented forests in Sarapiquí / Harold Arias (CATIE), Gabriela Jones (CATIE)
- Distribution and abundance of vascular epiphytes in tropical wet forest: A multiscale approach / Catherine Cardelús (U. Connecticut)
- Distribution and genetic variation of *Bactris* palms at La Selva / Sylvia Englund (Thomas J. Watson Foundation), Pedro León (U. Costa Rica)
- Distribution of two understory palms: *Asterogyne martiana* and *Geonoma cuneata* / Julissa Roncal (Florida International U.)
- Diversity and function of arbuscular mycorrhizal fungi / Catherine Lovelock (Smithsonian Environmental Research Center) / John Pandolfi (Smithsonian Environmental Research Center), Rachel Tenni (Smithsonian Scholarly Studies Program), Jane Wasly (Smithsonian Environmental Research Center), Sylvia Englund (Thomas J. Watson Foundation)
- Division of caste in *Platythyrea panclete* / Annegret Hartmann (Erlangen U., Germany)
- Dynamics of regeneration in wet tropical secondary forests: establishing a baseline for long-term monitoring (BOSQUES) / Robin Chazdon (U. Connecticut), Deborah Lawrence (U. Virginia) / Braulio Vilchez (ITCR), Uzay Sezen (U. Connecticut), Alvaro Redondo (ITCR), Marvin Castillo (ITCR), Luis Diego Carvajal (ITCR), Tara Wood (U. Virginia), Vivian Solano (UNA), Tatiana Robles (U. Costa Rica), Jennifer Dolan (Reed College)
- Ecology and behavior of tropical ponerine ants / Michael Breed (U. Colorado)
- Ecological basis of sustainability in reconstructed tropical ecosystems (HUERTOS) / Jack Ewel (USDA Forest Service) / Jenny Pérez (OTS), Miguel Cifuentes (OTS), Ankila Hiremath (U. Florida), Ricardo Bedoya Arrieta (OTS)
- Ecology and neurobiology of spatial memory in nectar feeding bats / York Winter (Munich U., Germany) / Johannes Thiele (Erlangen U., Germany), Mattias Helb (Erlangen U., Germany)
- Ecology and population genetic structure of *Azteca pittieri*, an obligate inhabitant of *Cordia alliodora* / Tilberg Chadwick (U. Colorado)
- Ecology of bats / John P. Hayes (Oregon State U.)
- Ecology of exclusive male parental care and polygynandry in Tinamous / Patricia L. R. Brennan (Cornell U.)
- Behavioral ecology of *Aphaenogaster araneoides* (HORMIGAS) / Terrence McGlynn (U. San Diego) / Justin Hoover (Gettysburg College), Geoff Jasper (Gettysburg College), Alexander Polis (Gettysburg College), Catherine Spangler (Gettysburg College)
- Ecology of nectar feeding bats / Otto Von Helversen (Erlangen U.) / Dagmar Von Helversen (Erlangen U., Germany), Marco Tschapka (Erlangen U., Germany), Detlev Kelm (Erlangen U., Germany), Marc Holderied (Erlangen U., Germany), Christof Althoff (U. Kiel, Germany), Oliver Behr (Erlangen U., Germany), Christiane Heindenfelder (Erlangen U., Germany), Kim Podszus (Erlangen U., Germany), Thomas Puettker (U. Kiel, Germany), Katja Soer (U. Costa Rica)
- Ecology of Neotropical Mycetozoans / Steve Stephenson (Hamilton College) / Donna Moore (Hamilton College), Mandy Hubbard (Hamilton College), Michael Powers (Hamilton College), Randy Darrah (Fairmont State College)
- Effects of abiotic variables on avian distribution patterns / Jai Ranganathan (U. Minnesota)
- Effects of herbivory on tropical tree diversity / Walter Carson (U. Pittsburgh) / Sean Tonkin (U. Pittsburgh), Gregory Bartus (U. Pittsburgh), Troy Mielke (U. Minnesota)
- Effects of volcanic processes on tropical streams (STREAMS) / Catherine M. Pringle (U. Georgia) / Alonso Ramírez (U. Georgia), Debbie Rowe (U. Georgia), Minor Hidalgo (OTS)
- Elements of CO₂ exchange in a tropical forest: Soil and bole respiration / Patrick Crill (U. New Hampshire), Michael G. Ryan (USDA Forest Service) / Andrew Mosedale (U. New Hampshire), Evilene Lopez (U. New Hampshire), Holly Barnard (Colorado State U.), Robert M. Hubbard (USDA Forest Service)
- Evaluation of the effects of the dispersion of seeds produced by howler monkeys / Susana P. Bravo (Museo Argentino de Ciencias Naturales)
- Evolution of fish egg size in Cichlidae / Ronald M. Coleman (U. California-Berkeley)
- Flight studies of the *Megaloprepus damselfly* (Odonata: Zygoptera) / Robert Stevenson (U. Massachusetts) / Frederick Saintours (U. Massachusetts)
- Flora of La Selva / Robert L. Wilbur (Duke) / Reinaldo Aguilar (INBio)
- Floral evolution in *Justicia* (Acanthaceae) / Kathleen Kay (U. Washington)
- Flower water relations in tropical forests / Sarah Moon Chapoffin (Harvard U.)
- Follicular lichens on real and plastic plant leaves: Investigating the mechanisms maintaining diversity in tropical rain forests / Robert Lücking (Bayreuth U., Germany)

As part of the Huertos Project, Ricardo Bedoya extracts water to determine soil quality. In Huertos, PI Jack Ewel works to determine the ecological underpinnings of sustainability.



Silvia Alvarado

Forest regeneration after cacao removal / Carol Horvitz (U. Miami) / *Rachel Beck-King (U. Miami), Ronald Lange (U. Miami), Mario Blanco (U. Costa Rica)*

Functional and descriptive morphology of *Bauhinia* liana stems / Mario Blanco (U. Costa Rica)

Geographic variation in Flycatcher song / Daniel Leger (U. Nebraska)

Habituation and census of Great Curassows / Ivan Jiménez, (U. Missouri-St. Louis) / *Gustavo A. Londoño (U. de Los Andes)*

Herbivory differences in two color variants of *Triolena hirsuta* and the effect on their population structure / Sarah McCarthy (Michigan State U.)

Hybridization in the genus *Bactris* / William Hahn (Columbia U.)

Hydropower development & river conservation in Sarapiquí, Costa Rica / Beth Anderson (U. Georgia), Miriam Ramos (U. Missouri- St. Louis)

Improved nursery production techniques for five natives tree species / Theodore Shear (North Carolina State U.) / *Kevyn Wightman (North Carolina State U.)*

La Selva digital elevation model and streams coverage / José Antonio Guzmán (ITCR)

Paleoecology and land use history of La Selva / Robert Sanford (U. Denver), Sally Horn (U. Tennessee) / *Chris Malone (U. Denver), Doan Cuong (U. Denver), Melissa McMahill (U. Denver), Roderick Morrison (U. Denver)*

Leaf litter herpetofauna abundance / Maya Pierce (Evergreen State College), Steven Whitfield (Evergreen State College)

Liana diversity and habitat distribution / Paul Foster (U. Michigan)

Local adaptation in the scale insect *Saissetia coffeae* (Homoptera: Coccidae) / Brian Spitzer (U. California-Davis)

Location of army ants for the birds that follow them / Johel Chavez (U. Costa Rica)

Long-term monitoring of parasitoids / John Pickering (U. Georgia)

Maintenance of bird populations in forest fragments associated with banana plantations / Bob Matlock (OTS) / *Brian Schwartz (OTS), Michael Dietze (OTS)*

Mating strategies of breeding amphibians / Neil Stuart Osborne (Trent U.)

Mixed plantations of native trees for the rehabilitation of disturbed habitats / Florencia Montagnini (CATIE) / *Carlos Reiche (CATIE)*

Molecular analysis of the wild species of the *Bactris* genus / Elena Castillo (U. Costa Rica), Marielos Mora (U. Costa Rica), Pedro León (U. Costa Rica).

Mortality factors in leaf miners: A comparison of ants as predators and parasitoids / Joachim Moeser (Hannover U., Germany)

Mutualisms between members of the Bromeliaceae and their aquatic invertebrate fauna / Mariele Anzelone (Rutgers U.)

Necrophagous insect successional changes from forest gaps to inner forest / Lisa Marie Gardner (Evergreen State College)

Nesting success of birds in continuous forest and forest fragments / Bruce Young (Nature Conservancy) / *Jim Zook (freelance), Rodolfo Alvarado (OTS), Adolfo Downs (OTS)*

Parental effects on offspring fitness in *Dendrobates pumilio* / Maura Maple (U. Kentucky)

Piper ant plants and trophic cascades / Lee Dyer (Tulane, U.), Deborah Letorneau (U. California-Santa Cruz)

Plant defense comparison of different age class leaves / Kelly Gleason (Evergreen State College)

Pollinators of *Calyptrogyne ghiesbreghtiana* / Marco Tschapka (U. Ulm, Germany) / *Jessica Ludwig (U. Ulm, Germany)*

Population response of insect herbivores and pathogens to native tree plantations / Elizabeth Braker (Occidental College), Heather Snookal (Occidental College)

Predicting bio-diversity with satellite images / Sallie Bailey (Stanford U.), Roy Richardson (Stanford U.)

Primate population studies at La Selva / Nora Bynum (OTS), Deedra McLearn (OTS) / *Brian Plaster (OTS)*

Productivity of dioecious species of *Virola koschnyi* and *Simarouba amara*, in a fragmented landscape in the North of Costa Rica / Jhon Mario Rodríguez (CATIE, Universidad Tecnológica Pereira)

Reproductive division of labor in Ponerine ants / Bruno Gobin (Erlangen U., Germany)

Reproductive ecology of *Psychotria* (Rubiaceae) / Shoko Sakai (Smithsonian Environmental Research Center)

Reproductive success in the bat *Saccopteryx bilineata* / Christian Voigt (Erlangen U., Germany), Gerald Heckel (Erlangen U., Germany) / *Sonja Meister (Erlangen U., Germany), Birgit Reuter (Erlangen U., Germany)*

Reproductive success of tropical trees in small forest fragments: analysis of gene flow, fruit set and inbreeding depression / Catherine Woodward (U. Wisconsin)

Sexual selection on woodcreeper song / James Mountjoy (Franklin & Marshall College) / *Katherine Brooks (U. Nebraska)*

Soil organic matter fractions and dynamics in experimental tropical ecosystems / Ann Russell (Iowa State U.)

Spatial distribution and temporal stability of *Cecropia petiole* beetle communities / Justin Calabrese (Arizona State U.)

Streamflow measurements in two tropical rainforest watersheds / David Genereux (North Carolina State U.) / *Walter Frielingsdorf (Florida International U.)*

Taxonomy and systematics of the grasses, sedges and rushes of La Selva / Trevor Hodgkinson (Trinity College Dublin, Ireland), Sandra Velthuis (Trinity College Dublin, Ireland)

The behavior and ecology of carrion decomposing insects / Chadwick Tillberg (U. Colorado)

The connectivity of vines and their effect on herbivory / Cheryl Pacheco (Evergreen State College)

The ecology and behavior of the army ants *Nomamyrmex esenbeckii* / Kjetil Aasen (Museum of Zoology, Norway)

The evolution of ant associations in *Piper* subgenus *Macrostachys* / Erick Tepe (U. Miami)

The interaction of plant defenses in *Loasa* and *Plantago* with their insect herbivores and environment / Marie Ann de la Fuente (U. Colorado)

The effects of trails on the plants diversity and composition / Renae Wieder (Villanova U.)

The evolution of reproductive isolation in hummingbird-pollinated *Costus* / Kathleen Kay (U. Washington) / Michelle Cooper (U. Washington)

The role of *Cecropia*-inhabiting ants on insects herbivore community structure and herbivore diversity in the Cecropiaceae / Louis LaPierre (U. California-Las Angeles)

The role of microarthropods in the decomposition of *Pentaclethra macroloba* / Jeff Lemieux (Oregon State U.), Emilie Grossmann (Oregon State U.) / Michelle Lemieux (Oregon State U.)

Traditional herbal medicines in Sarapiquí, La Selva: An ethnobotanical analysis / Stacey Crevello de Sánchez (Louisiana State U.)

Tree seedling dynamics in primary lowland rain forest / Diana Lieberman (U. North Dakota), Milton Lieberman (U. North Dakota) / Johnny Serrano (UNA)

Vocalizations in *Dendrobates pumilio* / Maureen Donnelly (Florida International U.) / Kirsten Hines (Florida International U.)

Winter habitat and behavioral ecology study of Willow Flycatchers (*Empidonax traillii*) in Costa Rica / Thomas Koronkiewicz (Northern Arizona U.)



Silvia Alvarado

Project Manager Alvaro Redondo measures the diameter of trees as part of the BOSQUES Project. Principal investigators Robin Chazdon, Deborah Lawrence and Braulio Vilchez study the spatial and temporal dynamics of secondary forests.

PALO VERDE BIOLOGICAL STATION

Demography of populations of *Guaiaecum sanctum* of Palo Verde and Garza, Guanacaste / Erick Hernández (U. Nacional, Costa Rica), Eugenio González (OTS)

Countryside biogeography of Costa Rica birds / James Zook (independent)

Development of contortions of the stem of "monkey's ladder", Guanacaste / Mario Blanco (Universidad de Costa Rica)

Determination of the border effect on the diversity of Palo Verde National Park / Guillermo Thiele (Centro Agronómico Tropical de Investigación y Enseñanza)

Dynamics of the tropical dry forest through permanent measuring plots at Palo Verde National Park, Costa Rica / Adrián Monge (Instituto Tecnológico de Costa Rica), Eugenio González (OTS), Ruperto Quesada (Instituto Tecnológico de Costa Rica)

The soil's seed bank in different successional stages of the tropical dry forest of Costa Rica / Claudia Scholz (Instituto Tecnológico de Costa Rica) and Eugenio González (OTS)

Study of the chronosequence of the tropical dry forest at Palo Verde Biological Station, Bagaces, Guanacaste / Zaida Hernández (Instituto Tecnológico de Costa Rica), Ruperto Quesada (Instituto Tecnológico de Costa Rica), Eugenio González (OTS)

Evaluation of the possible differences between *Alouatta palliata* and *Cebus capucinus* as seed dispersers in a tropical dry forest / Catherine Numa (U. Nacional de Colombia), Elizabeth Wehncke (Museo Nacional de Argentina)

Factors that determine the establishment and distribution of *Laguncularia racemosa* in high sedimented environments at the Pacific Coast of Costa Rica / Philippe Hansen (Louisiana State U.), Patricia Delgado (Louisiana State U.)

Gene flow into tropical forest fragments / James Hamrick (U. Georgia) / Victoria Apsit (U. Georgia), Dorset Trapnell (U. Georgia)

Impact of habitat fragmentation on bird movement in Guanacaste, Costa Rica / Cameron Gillies (U. Alberta)

Population size, reproduction sites and foraging of the Jabirú (*Jabiru mycteria*) at the Tempisque River Basin, Costa Rica / Johny Villarreal (U. Nacional, Costa Rica), Carmen Hidalgo (U. Nacional, Costa Rica)

Testing hypotheses for the benefits of group living in the Neotropical eusocial wasp *Polistes instabilis* / Adam Smith (U. Washington)

The effects of spatial and temporal heterogeneity in light and soil resources on seedling survival and growth in a tropical dry forest / Meera Iyer (Michigan State U.)

Environmental Policy

In fiscal year 2000, the OTS Environmental Policy Program offered three short courses for policymakers (North American, Hispanic Latin American, and Brazilian), a forum in Washington D.C. for U.S. policymakers and five workshops for park managers and other professionals. The Environmental Policy Program reaches professionals who devise and implement policies that affect tropical resources but who often have minimal training in environmental sciences. It also provides continuing education for professionals in the conservation and environmental fields.

Principios Ecológicos para el Desarrollo Sostenible en América Latina (00-6)

The Latin American Decision-Maker's two-week course included 19 professionals, representing 10 countries, and began in San José and traveled to La Selva, Tilarán, Monteverde, Palo Verde and Puntarenas in Costa Rica. The course covered nine principal themes: biological and ecological principles, forestry and natural forest management, environmental impacts and assessments, environmental law, conservation and development, ecotourism, environmental economics and valuation, environmental conflict resolution, and marine and coastal resources. A module on the Meso-American Biological Corridor (MABC), the most important conservation and development initiative in the region, was also added to the course's curriculum.

With support from the U.S. Fish and Wildlife Service, the Latin American Decision-Makers course received an overall evaluation this year. A questionnaire was sent to all past course participants and 22% of the group responded to the survey. The evaluation showed overwhelmingly that the alumni consider their participation worthwhile and beneficial. The respondents provided numerous examples of how their course experiences helped them to make more informed decisions regarding environmental conservation and sustainable resource use.

Coordinators: Raúl Solórzano (Centro Científico Tropical)
José María Rodríguez (OTS)

Participants:

Carlos A. Alvarado (Directorate for Emergency Prevention and Management, Colombia)
Sandra Arce (Legislative Assembly, Costa Rica)
Gerardo Chin (Ministry of Public Works and Transportation, Costa Rica)
Edelina Coayla (Federico Villarreal National U., Perú)
Rodrigo Crespo (Agricultural Corporation, Costa Rica)
Marcos Antonio Garrido (Rural Development Department, Chile)
Fidel Angel Granados (General Prosecutor's Office, El Salvador)
Nélida Grüber (Ministry of the Environment and Natural Resources, Venezuela)
Ricardo Guzmán (Forest Service, Bolivia)
Javier Agustín Labra (Puyehue National Park, Chile)
Luis Marroquín (General Prosecutor's Office, El Salvador)
Fernando Montero (Inter-American Institute for Agricultural Cooperation)
Giovanni E. Olmos (General Prosecutor's Office, Panamá)
Mario Piu (Galapagos National Park, Ecuador)
Marisol V. Sánchez (Tropical Forestry Action Plan, México)
Washington Tapia (Galapagos National Park, Ecuador)
Sergio Valdelomar (General Prosecutor's Office, Costa Rica)
Damaris Vargas (Agrarian Court of San José, Costa Rica)
Olga Vargas (Agrarian Development Institute, Costa Rica)



Javiar Mateo

Professionals in the Latin American Decision-Makers course see first-hand how banana plantations are addressing environmental concerns at Standard Fruit Company's Finca Zurquí.

Interdependence: Economic Development and Environmental Concerns (00-8)

The U.S. Decision-Makers course in Costa Rica included congressional aides, executive branch officials, representatives of private firms, international organizations, NGOs and unions. Topics at La Selva included wildlands and biodiversity conservation and use, changes in the Sarapiquí landscape, ecotourism, and environmental management in a banana plantation. Thomas Dodd, U.S. Ambassador in Costa Rica, gave a lecture on Central America's historic development. Hydro-generation, environmental impact assessment and payments for environmental services were covered on the way to the San Carlos area, where forestry was the theme. Topics in Palo Verde were migratory waterfowl, wetland management and restoration and the Arenal-Tempisque irrigation project. At Villa Blanca, Rodrigo Carazo, former president of Costa Rica, dialogued with participants on environmental policy and politics.

Coordinators: Katrina Brandon (Conservation International)
José María Rodríguez (OTS)

Participants:

Roger Ballentine (White House, Climate Change Task Force)
Tracy Cullinane (Monsanto Company, Government Affairs Office)
Greg Dotson (U.S. House, Office of Rep. Henry Waxman)
Christopher Frech (U.S. House, Office of Rep. Deborah Pryce)
Ladeene Freimuth (U.S. House, Office of Rep. Frank Pallone, Jr.)
Sharon Hayes (Dole Food Company, Worldwide Operations)
Teresa Hobgood (U.S. Department of State, Oceans, Environment & Science)
William Kennedy (UN Fund for International Partnership, United Nations)
Martin Kodis (U.S. Fish and Wildlife Service, Office of Congressional Affairs)
Patricia Koshel (U.S. EPA, Office of International Activities)

Elena Mateo Vega (U.S. Embassy, Environmental Hub for Central America)
John McCamman (U.S. House, Office of Rep. George Radanovich)
Stephen Mills (Sierra Club, International Programs)
John Mimikakis (U.S. House, Office of Rep. Sherwood Boehlert)
Jeffrey Miotke (U.S. Department of State, Office of Global Change)
David Mitchell (Duke Energy, Federal Government Affairs)
Eric Mondero (U.S. House, Office of Rep. Ron Packard)
Andrea Nelson (U.S. Bureau of Reclamation, U.S. Department of Interior)
Melissa Othman (USDA Forest Service, International Programs)
Jane Perkins (AFL-CIO)
George Platt (Wetlandsbank, Inc.)
Ana Quirós (ECO GLOBAL, S.A.)
Frank F. Rivera-Milan (U.S. Fish & Wildlife Service)
Roby Roberts (Renewable Energy Policy Project, CREST)
David Spielfogel (White House, Council on Environmental Quality)

Global Climate Change: Recent Developments and Implications for Tropical Forests

The Policy Dialogue Series for U.S. Decision-Makers was designed to provide course alumni with additional training opportunities, to address new environmental issues and to expand training to reach other policymakers. This, the third event in the series, took place in Washington D.C. and was attended by thirty-four people and included a welcome by Representative David Price (D-NC). Christiana Figueres, Executive Director of the Center for Sustainable Development in the Americas, spoke about the overall problem and causes of global climate change, emphasizing the compelling reasons for including preservation of forests worldwide in international strategies to mitigate climate change. Ralph Dubayah (U. Maryland) presented information on a cutting edge remote sensing mission sponsored by NASA to measure the amount of carbon stored in forests worldwide, using La Selva Biological Station as the test site. The project is a test of NASA's Vegetation Canopy Lidar system to create a baseline of carbon content in forests which can then be used to determine rates of carbon release or sequestration.

El Corredor Biológico Mesoamericano para Conservar la Vida y Promover el Desarrollo

OTS developed a series of seminars to train leaders from Central America to gain their support for the construction and consolidation of the Meso-American Biological Corridor (MABC), an ambitious conservation initiative. The goal of the MABC is to strengthen a select group of protected wildlands in every Central American country and the five southeastern states of Mexico, and to link these wildlands through conservation and compatible land uses. This program comprises a variety of activities, heavily involving the inhabitants and neighbors of the corridor to secure their collaboration with the conservation goals. It is expected that the program will ensure the long-term conservation of the rich biodiversity of this region and the wild gene flow along the entire isthmus. With initial funding from World Wildlife Fund-Central America, this project will include a total of six seminars over three years.

The first Meso-American Biological Corridor seminar in the series of six included presentations and discussions on sustainable development and the relevance of the corridor.



José María Rodríguez

Coordinators: José María Rodríguez (OTS)
Raúl Solórzano (Centro Científico Tropical)
Juan Carlos Godoy (MABC Technical Liaison, Guatemala)

Participants:

Bartolo Teul (Golden Stream Corridor Preserve Project, Belice)
José Novelo (Northern Belize Biological Corridor Project)
Alfonso Barrantes (National Forestry Office, Costa Rica)
Félix Méndez (Siquirres Agricultural Center, Costa Rica)
Rigoberto Magaña (El Salvador Environmental Fund)
Benjamín Pacas (AGRISAL, El Salvador)
Nelson Amaya (Ministry of Foreign Affairs, El Salvador)
Andrés Cuz (Maya Forestry Action Plan, Guatemala)
Carlos Roberto Morales (Environment and Natural Resources Secretariat, Guatemala)
Oswaldo Morales (Guatemala Chamber of Industry)

Jacqueline Foglia (PATUCA Foundation, Honduras)
Laura Garay (Technical Support Unit to the President, Honduras)
Sonia Palomo (Honduran Council of Private Enterprise)
Bayardo Quintero (Ministry of Environment and Natural Resources, Nicaragua)
Darwin Juárez (Association of Environmental Journalists of Nicaragua)
Alfonso Jaén (Private Reserves Network of Panamá)
Irving H. Bennett (Natura Foundation, Panamá)
Luis Villarreal (Panamanian Foundation of Environmental Services)

Manejo de Areas Silvestres Tropicales

Although many Latin American countries have established protected wildlands, protection continues to be hindered by weak institutional and regulatory structures, colonization pressures, poor management programs, poverty in surrounding communities, shrinking budgets and limited knowledge of existing resources. As a result, many of Latin America's wildlands, estimated to harbor as much as 70% of the species found on Earth, are not being adequately protected. In conjunction with the U.S. Fish & Wildlife Service, OTS designed the course "Wildlands Management in the Tropics" to significantly improve the capacity of managers to better administer and conserve protected and ecologically important wildlands in the region. The course included lectures, group discussions and, in the OTS tradition, intensive, hands-on, field oriented projects. A variety of topics were addressed, including wildlands conservation systems, biodiversity conservation, development and conservation, participatory decision making and environmental interpretation. The course trained Latin American managers in strategic and practical approaches to wildlands management, with a vision toward promoting the sustainable use and conservation of wildlife, natural resources and important habitats in the region.

Coordinators: José María Rodríguez (OTS)
Co-coordinator: Alberto Vásquez (UNED)

Participants:

Alfredo Wüthrich (National Parks Administration, Argentina)
Florencia Trama (National Parks Administration, Argentina)
Mario Luis Malajovich (Commission for the Yabofí Biosphere Reserve, Argentina)
Simón Cuminetti (National Parks Administration, Argentina)
Mario Diego Liliénfeld (Cotapata National Park, Bolivia)
Carlos Arturo Poveda (Vicente Pérez Rosales National Park, Chile)
Eduardo Mora (Puyehue National Park, Chile)
José Antonio Gayozo (Puyehue National Park, Chile)
Andrés Rivera (Otún Quimbaya Fauna and Flora Sanctuary, Colombia)
Edgar Castro (Cahuinari National Park, Colombia)
Luz Mery Martínez (Septiembre Station, Colombia)

Natalia Gómez (Valle del Cauca Autonomous Corporation, Colombia)
Sergio Márquez (Darién Special Management Area, Colombia)
Freddy Salazar (Cocos Island Marine Conservation Area, Costa Rica)
Marcos Madrigal (Manuel Antonio National Park, Costa Rica)
Mario Gutiérrez (Matanzas, Cuba)
Kleber Aguilar (Galápagos National Park, Ecuador)
María Eugenia Proaño (Charles Darwin Scientific Foundation, Ecuador)
Sixto Naranjo (Native Species Protection Unit, Galápagos National Park, Ecuador)
Javier Márquez (Sierra del Lacandón National Park, Guatemala)
Miguel Pereira (Laguna del Tigre National Park, Guatemala)
Cristóbal Díaz (Durango, México)
Daniel Ceballos (Banco Chinchorro Biosphere Reserve, México)
Deidad Partida (Las Joyas Scientific Station, Sierra del Manantlán Biosphere Reserve, México)
Delfina Rodríguez (National Institute of Ecology, SEMARNAP, México)



National park managers from nine Latin American countries experienced the unique habitats of Palo Verde National Park as part of *Wildlands Management in the Tropics*.

Flood Protection, Stream Restoration and Water Quality Workshops

More than 135 people participated in OTS' Tempisque River Basin initiatives in fiscal year 2000. Three international workshops were sponsored by the H. John Heinz III Center for Science, Economics and the Environment, the Costa Rica-USA Foundation (CRUSA), the U.S. Fish and Wildlife Service and the Ramsar Convention. In addition, OTS' Costa Rican Institutional Committee (CRIC) sponsored two other workshops for university students.

Alternativas para el Control de las Inundaciones y Conservación de Humedales - Tempisque *Flood Protection Alternatives and Wetland Conservation in the Tempisque River Basin*

Coordinators: Sheila D. David (The Heinz Center)
Jorge Jiménez (OTS)
Eugenio González (OTS)

Participants:

Sarah Baish (The H. John Heinz III Center for Science, Economics and the Environment, U.S.)
José Luis Bolaños-González (El Viejo, S.A. Mill and Sugar Plantation, Costa Rica)
Carlos M. Burgos-Salas (Ministry of Public Works and Transportation, Costa Rica)
Julio C. Calvo-Alvarado (Tropical Science Center, Costa Rica)
Marvin Coto-Hernández (National Service of Underground Water, Irrigation and Drainage, Costa Rica)
Shannon E. Cunniff (Bureau of Reclamation, U.S.)
Sheila D. David (The H. John Heinz Center for Science, Economics and the Environment, U.S.)
Alvaro Fernández-González (U. Costa Rica)
Eugenio González (Palo Verde Biological Station, Costa Rica.)
William L. Graf (Arizona State U., U.S.)
Gary Hartshorn (OTS, U.S.)
Sara E. Johnson (Trout Unlimited, U.S.)

Jorge Arturo Jiménez (OTS, Costa Rica)
Alfonso Mata-Jiménez (Tropical Science Center, Costa Rica)
Mary Hope Katsouras (The H. John Heinz Center for Science, Economics and the Environment, U.S.)
Javier Mateo-Vega (OTS, Costa Rica)
Michael E. McClain (Florida International U., U.S.)
William J. Merrell, Jr. (The H. John Heinz Center for Science, Economics and the Environment, U.S.)
William Murillo-Montero (National Service of Underground Water, Irrigation and Drainage, Costa Rica)
Rafael Oreamuno-Vega (U. Costa Rica)
Gordon Orians (Emeritus U. Washington, U.S.)
David Policansky (National Research Council, U.S.)
Carlos Quesada-Mateo (Research Center on Sustainable Development, Costa Rica)
William Robertson IV (The Andrew W. Mellon Foundation, U.S.)
José Luis Salas-Zúñiga (Ministry of Environment and Energy, Costa Rica)
Dan Shrubsole (U. Western Ontario, Canada)
Henry Vaux (U. California, U.S.)
Gretchen Wagner (The Andrew W. Mellon Foundation, U.S.)
David L. Wegner (Ecosystem Management International, Inc., U.S.)

Participants in the Flood Protection workshop visited 12 protected wildlands in Costa Rica, including Palo Verde, spanning a wide array of management categories and levels, ecosystems and socioeconomic contexts.



Pete Carmichael

El Agua en el Río Tempisque: Calidad, Flujos y Conservación *The Water of the Tempisque River: Quality, Flows and Conservation*

Coordinators: Eugenio González (OTS)
Marval Godoy (OTS)

Participants:

Adolfo Vásquez Rojas (Japan International Cooperation Agency, Costa Rica)
Alexis Rodríguez (Center for the Investigation of Environmental Pollution, Costa Rica)
Andres Phillips Urena (Ministry of the Environment and Energy, Costa Rica)
Angel Manuel Guevara Villegas (Ministry of Environment and Energy, Costa Rica)
Beth Middleton (Southern Illinois U., U.S.)
Elba M. De La Cruz Malavassi (National Autonomous U., Costa Rica)
Franklin Flores Cubero (National Emergencies Commission, Costa Rica)
Gilbert Fuentes González (OTS, Costa Rica)
Hugh Popenoe (U. Florida, U.S.)
Javier Mateo Vega (OTS, Costa Rica)
Jorge Arturo Torres Ortega (Association for the Management of the Tempisque River Watershed, Costa Rica)

Juan Carlos Romero Jiménez (Association for Sustainable Development of the Tempisque Conservation Project, Costa Rica)
Julio César Calvo Alvarado (Tropical Science Center, Costa Rica)
Luisa Eugenia Castillo Martínez (National Autonomous U., Costa Rica)
Marco Antonio Solano Salazar (National Aqueducts Service, Costa Rica)
Marcos González Rojas (National Autonomous U., Costa Rica)
Marvin Barrantes Castillo (National Service of Underground Waters, Irrigation and Drainage, Costa Rica)
Masanobu Sakurai (Japan International Cooperation Agency, Japan)
Nora Pineda Cordero (National Service of Underground Waters, Irrigation and Drainage, Costa Rica)
Porfirio Machado (Costa Rican Institute of Electricity)
Rafael A. Oreamuno Vega (U. Costa Rica)
Ramon Narvaez Sequeira (Ministry of Health, Costa Rica)
Roque Davila Ponce (Ministry of Health, Costa Rica)
Sandra León Coto (National Autonomous U. Costa Rica)
Warren Crowther (United Nations, U. Costa Rica, Latina U.)
Xinia María Campos Palma (Ministry of Environment and Energy, Costa Rica)

Restauracion de Riberas de Ríos y Quebradas De Agua Dulce
Restoration of Riverbanks and Freshwater Streams

Coordinators: Marie Sullivan (USFWS)
Eugenio González (OTS)
Marval Godoy (OTS)

Participants:

Adrian Byron Mota Vidaurre (Prominas, S.A y Cementos Progreso, S.A., Guatemala)
Ana Cecilia Martínez Artavia (Conflict and Collaboration in Natural Resource Management in Latin America and the Caribbean Program, U. Costa Rica)
Angel Manuel Guevara Villegas (Ministry of the Environment and Energy, Costa Rica)
Edilberto Estevez Molina (Organization for the Development of Corquín, Honduras)
Elvin Guillermo Guzman Lopez (Foundation for the Autonomy and Development of the Nicaraguan Atlantic Coast)
Emel Rodriguez Paniagua (Mesoamerican Biological Corridor Project, Costa Rica)
Franklin Antonio Briceno Martínez (Foundation for the Conservation and Development of Southeastern Nicaragua)
Hector Orlando Arita Polanco (Trinational Commission for the Trifinio Plan, Honduras)
Jimmy Mauricio Quintero Martínez (Colombian Institute for Development of Science and Technology)
Joel Ramos Garcia (JICATUYO Project, Honduras)

Jóse Pablo Azofeifa Retana (National Autonomous U., Costa Rica)
Juan Carlos Godoy Herrera (Mesoamerican Biological Corridor Project, Guatemala)
Jual Cornelio Sacida Ruíz (Foundation for the Conservation and Development of Southeastern Nicaragua)
Kathia Izel Castillo Corrales (Panamanian School of Biologists)
Luisa Isabel Moreno Scott (Monteverde Conservation Association, Costa Rica)
Maria Del Rosario Aruaz Rodríguez (National Association for the Conservation of Nature, Panamá)
Maria Isabel Castro Rebolledo (Javeriana U., Colombia)
Nicolino Troncoso González (Association for the Promotion of New Development Alternatives, Panamá)
Nora Pineda Cordero (National Service of Underground Waters, Irrigation and Drainage, Costa Rica)
Nury Edith Rojas Prado (Project for the Sustainable Use of the Marshes in the Pacific Coast of Guatemala)
Oscar Gerardo Cadavid Arango (Autonomous U. Corporation of the West, Colombia)
Pedro Joaquín Ruíz Carcache (Ministry of the Environment and Natural Resources, Nicaragua)
Ricardo Chinchilla Murillo (National Service of Underground Waters, Irrigation and Drainage, Costa Rica)
Xinia Campos Palma (Ministry of the Environment and Energy, Costa Rica)

Environmental Education

The OTS Environmental Education Program works to educate a broader audience to promote sustainable development activities. In this way, OTS biological stations act as living classrooms to infuse knowledge into the local communities.

BioCursos

BioCuros was developed in fiscal year 2000 to reach Costa Ricans with the message of conservation. More than 1,100 Costa Rican citizens participated in 37 weekend programs, including courses on birdwatching, medicinal plants, nature photography, turtles and frogs. Each course was taught in Spanish by specialists in the field and attracted participants of all ages and from all walks of life.

Traditional Nature Walks, Open Houses and Special Events. School children and local residents visited OTS biological stations to learn about biodiversity and the significance of science in protecting tropical forests. Environmental outreach activities were coordinated throughout the year in conjunction with special events and festivals, as well as with station open houses.

Participants in *Extracting and Using Essential Oils from Costa Rican Plants* were taught how oil is removed from plants to make repellents, insecticides, disinfectants, and perfumes. This course was one of 37 offered as part of the BioCursos Program.

Science Education in Local Communities. La Selva expanded the environmental education program in the local schools to include grades 4, 5 and 6. The 4th grade curriculum focuses on natural history, 5th grade on ecological processes and 6th grade on interactions between the human population and the environment.

Las Cruces coordinated with the local elementary school to collect garbage along the area roadways to celebrate World Environment Day. Sixty children participated and joined in a discussion about trash management problems: causes, consequences, and possible solutions and actions.

As part of the Adopt-A-Stream program the agroecology students from the Umberto Melloni Technical High School (CTPUM) in San Vito, participated in activities, including field research or work in the laboratory.



Ronald Rodriguez

Las Cruces Biological Station

Las Cruces is located on Costa Rica's southern Pacific slope and is OTS' 266-hectare reserve of mid-elevation rain and cloud forest. Las Cruces is also home to the Robert and Catherine Wilson Botanical Garden, a 10-hectare managed area consisting of one of the most important living botanical collections in Central America.

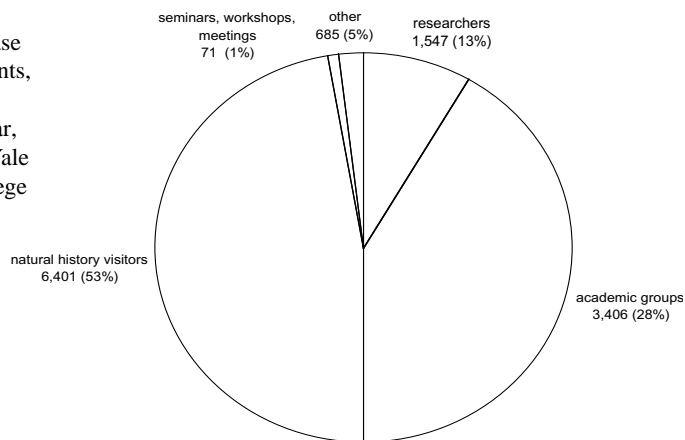
Visitation

Las Cruces received 6,096 visitors during the year, a 7% increase from fiscal year 1999, and included 154 researchers, 782 students, 4,888 natural history visitors and 58 workshop, seminar and meeting participants. Las Cruces hosted groups during the year, including courses and workshops from Longwood Gardens, Yale University, International Heliconia Society, Sierra Nevada College and INBio.



Virginia Monge

Forester Ronald Salazar oversaw the planting of native species, each in blocks of twenty to a hectare, in Melissa's Meadow.



6,093 people visited Las Cruces in fiscal year 2000 and totaled 12,110 person-days, as outlined above.

Conservation

The reforestation of Melissa's Meadow took off in earnest with seedlings donated by EARTH, carried to the site on horseback and planted under the design and supervision of forester Ronald Salazar and Rodolfo Quirós (Station Naturalist). The first five hectares are planted. Seeds donated by CATIE allowed the start of the on-site nursery that will eventually provide seedlings for the reforestation of the 14 hectares recommended by the Melissa's Meadow *ad hoc* reforestation committee. Censusing and inventorying of existing second growth in Melissa's Meadow was completed between May and July with the help of an intern provided and funded by Wellesley College.

Facilities and Resources

The Index Plantarum (the plant records) continues to be updated at generic and specific levels as staff work to cope with the numerous and dramatic changes at the family level. The Biodiversity Database continues to grow with additions from course groups and individual research projects, as well as an exchange of information with other agencies such as INBio. Living collections grew with 36 accessions of native and rare plants, including the first specimen of Canellaceae registered for the country and a growing collection of annuals of particular interest for ethnobiology and tropical medicine courses.

Research Highlights

In fiscal year 2000, 87 researchers conducted 52 projects at Las Cruces. The University of Costa Rica's Department of Archaeology, with support from the Andrew W. Mellon Foundation through U. Tennessee, launched an exhaustive survey of pre-Columbian and post-contact Amerindian habitational sites at Las Cruces, environs and Greater Coto Brus. The project identified a score of important archaeological sites previously unknown and, most importantly, increased the awareness of the present population about the scientific value of cultural remains. A large deposit of Pleistocene megafauna was discovered, with well-conserved remains of mastodons and horses.

Publications

Twenty-one scientific publications, based on research conducted at Las Cruces/Wilson Botanical Garden, were published during 1999 and 2000.

La Selva Biological Station

With its state-of-the-art laboratories, on-line geographic information system, extensive trails and large forest reserve bordering Braulio Carrillo National Park, La Selva is one of the world's most important sites for tropical forest research. La Selva is located in the Caribbean lowlands of Costa Rica and comprises 1,516 hectares of old and secondary growth forests, plus experimental habitats.

Visitation

The total number of visitors in fiscal year 2000 was 10,935, an increase from 9,571 last year, and included 917 researchers, 4,562 students and faculty, and 5,153 natural history visitors. La Selva hosted 178 different groups during the year, including courses and workshops from University of Costa Rica, University of British Columbia, Pepperdine University and Duke's Talent Identification Program, to name a few.

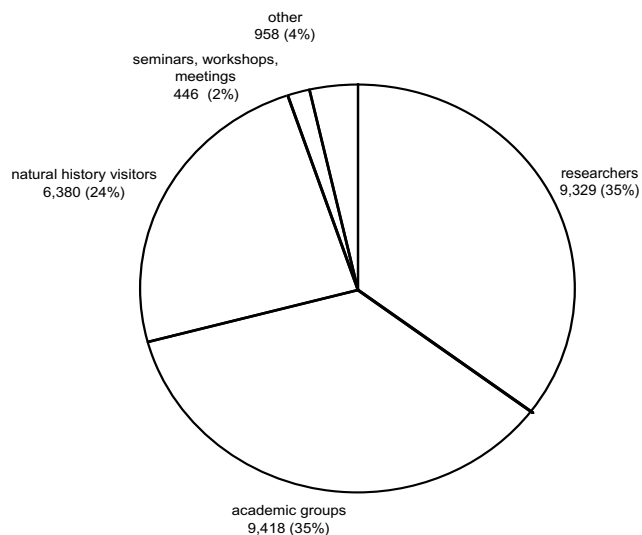
Facilities and Resources

The new La Selva education building was sited in the lab clearing behind the old lab, design work completed and construction planned for fiscal year 2001. The National Science Foundation provided funds for twelve new single occupancy cabins for senior researchers, a new laboratory for the ALAS project and for 3 km of paved trails all to be completed in fiscal year 2001. La Selva's Geographic Information System (GIS) laboratory renewed its UNIX ARC/INFO license, acquired a WINDOWS NT license for both ARC/INFO and ARCVIEW, a license for ERDAS Imagine remote sensing software, and LANDSAT imagery for all of Costa Rica (all via donations). The GIS lab surveyed the entire 60 km La Selva trail system, documenting obstructions (mud holes, difficult slopes), needed bridges and overall user impact. A 5-year trail maintenance plan was developed. New bridges were built over the Taconazo Creek and along the STR trail. In addition, the SUR-LOC shortcut trail was improved.



Dan Nelson

Due to the research history, forest reserve and facilities, students from both OTS and non-OTS courses continue to rank La Selva as one of the best places on their course itinerary. Each group begins their stay with an introductory walk with one of La Selva's naturalists.



10,935 people visited La Selva in fiscal year 2000 and totaled 26,531 person-days, as outlined above.

Research Highlights

In fiscal year 2000, 282 researchers (principal investigators and research assistants) conducted 118 projects at La Selva. New long-term La Selva projects included Jack Ewel (U.S. Forest Service) and Nalini Nadkarni's (Evergreen State College) "Changes in resource acquisition by plants of different life as a function of their age and stature (EPI-HUERTOS)" funded by the Andrew W. Mellon Foundation and Catherine Lovelock's (Smithsonian Institution) "Host and Environmental Controls on the Arbuscular Mycorrhizae Symbiosis in Tropical Forests".

Publications

In fiscal year 2000, 99 scientific publications and 13 doctoral dissertations and master theses, based on research conducted at La Selva, were published. Of special note were Naskrecki's *Katydid of Costa Rica* published by the Orthopterists' Society and Weishampel, Blair, Knox, Dubayah and Clark's "Volumetric LIDAR return patterns from an old-growth tropical rainforest canopy" published in the *International Journal of Remote Sensing*.

Palo Verde Biological Station

Unique in its landscape richness and wildlife, Palo Verde National Park contains one of the most extensive marshes and some of the oldest patches of dry forest remaining in Central America. The OTS facilities are in the heart of the Palo Verde National Park, located in the northwest lowland of Guanacaste Province.

Visitation

During fiscal year 2000, 2,016 people visited Palo Verde, up from 1,324 people in fiscal year 1999, and included 1,124 students, 97 researchers, 606 natural history visitors and 86 people from workshops, seminars and meetings. Palo Verde hosted more than 40 groups during the year, including courses from Furman University, Michigan State University and Dartmouth College.

Facilities and Resources

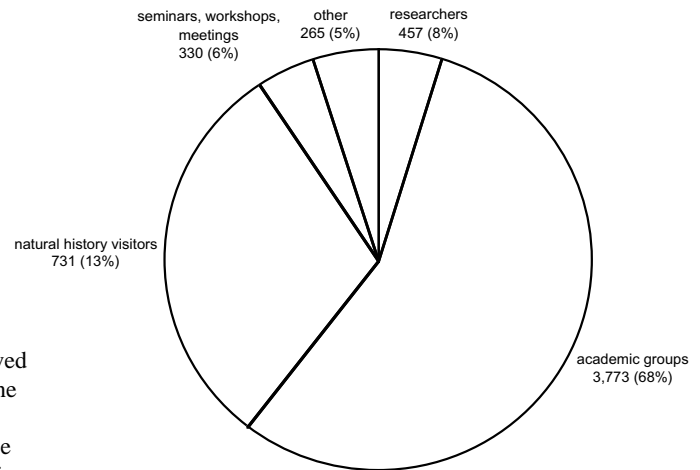
Matambú, the original building, was remodeled to make eight rooms with two bunk beds each, and the classroom was improved with air conditioning and new audiovisual equipment. Telephone lines, a modern digital microwave radio communication system and a local area network were installed and offer the first reliable phone service to the station, eight ports for Internet connection in the classroom, transmission of images, voices and data and a dedicated communication line (128 kbps) with the OTS server in San José. The on-site plant collection, currently with 497 specimens out of a total of 688 species reported for the area, was updated in collaboration with the Park Service. The library collection continued to grow and includes more than 400 scientific papers on a broad range of fields related to the Tempisque lowlands, plus OTS course reports and general textbooks. In addition, a new shade house with workbenches, wooden boxes with sand and a shaded area of 6 x 8 m is now available for station users to conduct experiments under controlled conditions. The capacity to offer more services at Palo Verde improved significantly with the addition of new staff Mauricio Solís and Nicole Turner, both graduates of biology at the Universidad Nacional, who assist students and natural history visitors with guided walks and lectures on Palo Verde natural history. A reception office and gift shop were also opened.

Research Highlights

In fiscal year 2000, 20 researchers conducted 14 projects at Palo Verde. Noteworthy projects include Meera Yer's (Michigan State U.) *Seedling Survival and Growth in a Tropical Dry Forest*. In this study, Yer is investigating the effects of spatial and temporal heterogeneity in light and soil resources on the growth and survival of tree seedlings in the tropical dry forest, the first study to explore variation in soils across the Park, along topographic gradients and as a function of former land-use. Information on how trees, all commercially important species, are affected by site characteristics, such as soil and light availability levels, will prove very useful to land managers involved in restoration, plantations and agroforestry.

Publications

In 1999 and 2000, 22 scientific publications, based on research conducted at Palo Verde, were published.



2,016 people visited Palo Verde in fiscal year 2000 and totaled 5,556 person-days, as outlined above.

Conservation

The OTS-ACT Commission (joint project between OTS and Area de Conservación Tempisque) worked closely with the park managers to coordinate activities, such as the research workshop, facilitated by the CRIC committee, *Flood Control and Wetland Conservation*, held last May in Palo Verde. In addition, Eugenio González, Palo Verde Director, participated in the local Institutional Commission appointed to monitor and observe the implementation and impacts of the Arenal-Tempisque irrigation project.



Javiar Mateo

Participants in the *Flood Protection* workshop take advantage of one of the new services at Palo Verde. Students, researchers, meeting and workshop participants and natural history visitors now have access to horses, boats and bikes.

Development

Annual Fund

The OTS Annual Fund raised a total of \$347,206 in unrestricted revenues during fiscal year 2000. As in the past, many donors targeted their contributions to specific program areas: \$28,951 for La Selva Biological Station, \$96,065 for Las Cruces Biological Station/Wilson Botanical Garden, \$971 for Palo Verde Biological Station and \$221,219 for general operations. Gifts to the Annual Fund support the organization's on-going operations.

Restricted Grants and Contracts

The following grants and contracts were awarded to OTS in fiscal year 2000:

<i>Donor</i>	<i>Purpose</i>	<i>Amount</i>
CRUSA Foundation	<i>Flood Control Alternatives and Wetland Conservation on the Lower Tempisque River Basin Workshop</i>	\$94,000
National Science Foundation	Undergraduate Minority Scholarships	\$69,930
National Science Foundation	Graduate Scholarships for <i>Ecología da Floresta Amazônica (00-12)</i>	\$59,320
Peace Frogs	Amphibian Research Fellowships	\$5,000
US Fish and Wildlife Service	US and Latin American Decision Makers courses, <i>Wildlands Management</i> course, Palo Verde boat	\$118,500
Andrew W. Mellon Foundation	3M Initiative – Multi-Site, Multi-Investigator, Multi-Disciplinary Training for Plant Ecology Graduate Students	\$415,000
	Total Grants and Contracts	\$761,750

Donors

A special thanks to the following individuals, foundations, corporations and government agencies for their support in fiscal year 2000 (July 1, 1999 - June 30, 2000). It is only through such support that OTS can continue to provide leadership in education, research and the responsible use of natural resource in the tropics.

GRAND SPONSORS (\$100,000+)

Andrew W. Mellon Foundation
National Science Foundation

Richard H. Simons Charitable Trust
U.S. Fish and Wildlife Service

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Chris and Vorna Young

In addition, many thanks to our friends for the various forms of in-kind support given to OTS throughout fiscal year 2000. These gifts included equipment, books, periodicals, gift-shop merchandise and services. A very special thank you to members of our Board of Directors, Assembly of Delegates and Board of Visitors for their generous gifts of time and expertise and for absorbing many costs associated with their involvement in this organization.

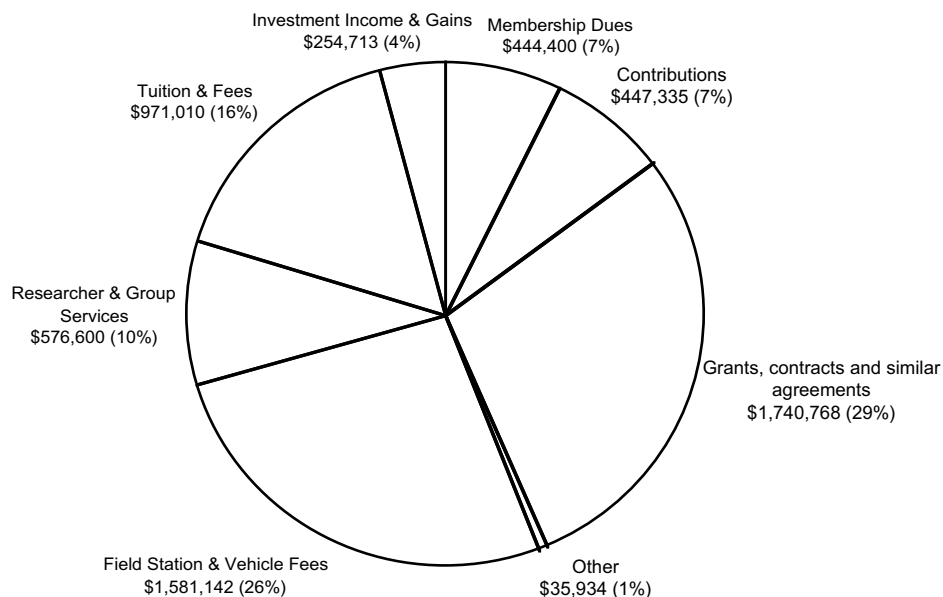
Despite every effort to avoid them, errors may occur in this annual report. If your name has been omitted or misprinted, please notify us and accept our apologies.

Finances

Fiscal year 2000 resulted in a growth in net assets of \$150,216. In spite of program expansion, expenses showed only modest increases from the preceding fiscal year. Revenue and support remained steady. Grants and contributions were vital to support on-going operations, as they accounted for more than 36% of the total revenue in 2000.

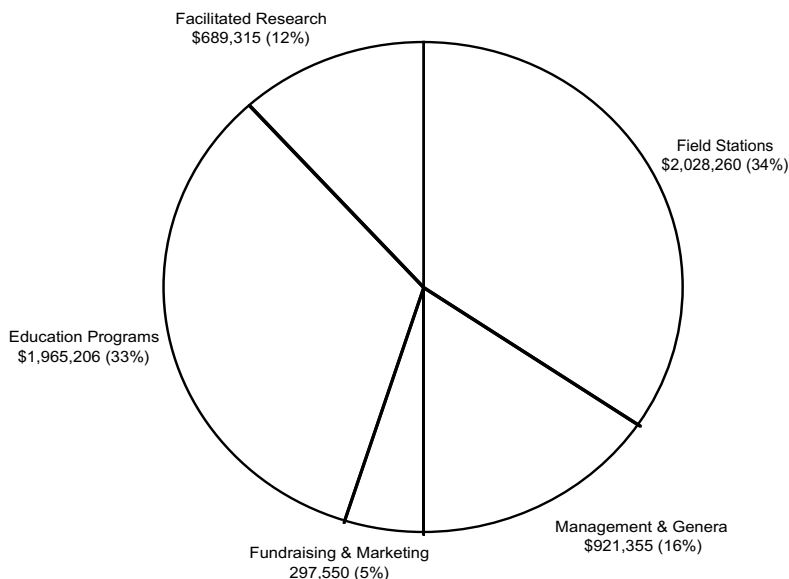
Support and Revenue

\$6,051,902



Expenses

\$5,901,686



The following audited financial statements contain columns for both OTS and for ESINTRO, the for-profit subsidiary in Costa Rica created in 1995 to handle OTS sales and related taxable items.

Audited Financial Statements

Independent Auditors' Report

The Board of Directors
Organization for Tropical Studies, Inc.:

We have audited the accompanying consolidated statement of financial position of the Organization for Tropical Studies, Inc. and subsidiary (the "Organization") as of June 30, 2000, and the related consolidated statements of activities and cash flows for the year then ended. These consolidated financial statements are the responsibility of the Organization's management. Our responsibility is to express an opinion on these consolidated financial statements based on our audit. The prior year summarized comparative information has been derived from the Organization's 1999 financial statements and, in our report dated September 29, 1999, we expressed an unqualified opinion on those financial statements.

We conducted our audit in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Organization for Tropical Studies, Inc. and subsidiary as of June 30, 2000 and the changes in its net assets and its cash flows for the year then ended in conformity with accounting principles generally accepted in the United States of America.

February 23, 2001

KPMG LLP

ORGANIZATION FOR TROPICAL STUDIES, INC. AND SUBSIDIARY

Consolidated Statement of Financial Position

June 30, 2000

(with comparative financial information as of June 30, 1999)

Supplementary Information

	Organization for Tropical Studies, Inc.			
	ESINTRO	2000 Total	1999 Total	
Assets				
Cash and cash equivalents (notes 3 and 7)	\$1,503,822	19,925	1,523,747	1,360,511
Accounts receivable, less allowance for doubtful accounts of \$18,476 in 2000 and \$9,437 in 1999 (note 6)	265,171	33,574	298,745	112,090
Grants and contributions receivable, net	144,907	—	144,907	23,401
Investments (note 3)	3,725,854	—	3,725,854	3,851,357
Land, buildings and equipment, net (note 4)	2,569,224	7,152	2,576,376	2,631,631
Other assets	37,682	46,739	84,421	75,118
Total assets	8,246,660	107,390	8,354,050	8,054,108
Liabilities and Net Assets				
Liabilities:				
Accounts payable	32,881	—	32,881	67,693
Other liabilities	526,552	23,276	549,828	378,478
Accumulated postretirement benefit liability (note 8)	129,986	—	129,986	116,798
Total liabilities	689,419	23,276	712,695	562,969
Net assets:				
Unrestricted (notes 5 and 7)	4,691,711	84,114	4,775,825	4,740,566
Temporarily restricted (note 5)	2,010,845	—	2,010,845	1,929,246
Permanently restricted (note 5)	854,685	—	854,685	821,327
Total net assets	7,557,241	84,114	7,641,355	7,491,139
Contingencies (note 7)				
Total liabilities and net assets	\$ 8,246,660	107,390	8,354,050	8,054,108

See accompanying notes to consolidated financial statements.

ORGANIZATION FOR TROPICAL STUDIES, INC. AND SUBSIDIARY

Consolidated Statement of Activities

Year ended June 30, 2000

(with summarized financial information for the year ended June 30, 1999)

	<u>Supplementary Information</u>						
	<u>Organization</u>						
	<u>for Tropical</u>						
	<u>Studies, Inc.</u>	<u>ESINTRO</u>	<u>Total</u>	<u>Temporarily</u>	<u>Permanently</u>	<u>2000</u>	<u>1999 Total</u>
	<u>Unrestricted</u>	<u>Unrestricted</u>	<u>Unrestricted</u>	<u>Restricted</u>	<u>Restricted</u>	<u>Total</u>	<u>(note 2)</u>
Revenues:							
Operating revenues and support:							
Membership dues	\$ 444,400	—	444,400	—	—	444,400	411,600
Grants, contracts and similar agreements:							
(note 6)	92,580	—	92,580	1,648,188	—	1,740,768	1,616,096
Contributions	379,961	—	379,961	34,016	33,358	447,335	514,002
Field station fees	966,847	498,691	1,465,538	—	—	1,465,538	1,202,258
Vehicle rental fees	115,604	—	115,604	—	—	115,604	105,312
Researcher and group services	576,600	—	576,600	—	—	576,600	454,507
Tuition and fees	971,010	—	971,010	—	—	971,010	831,478
Investment income	121,260	—	121,260	142,727	—	263,987	209,119
Unrealized (loss) gain on investments	(2,689)	—	(2,289)	(6,585)	—	(9,274)	106,001
Other	35,934	—	35,934	—	—	35,934	154,594
Total operating revenues	3,701,507	498,691	4,200,198	1,818,346	33,358	6,051,902	5,604,967
Net assets released from restrictions (note 5)	1,736,747	—	1,736,747	(1,736,747)	—	—	—
Total revenues and other support	5,438,254	498,691	5,936,945	81,599	33,358	6,051,902	5,604,967
Expenses:							
Program expenses:							
Field stations	1,575,900	452,360	2,028,260	—	—	2,028,260	2,101,670
Education programs	1,965,206	—	1,965,206	—	—	1,965,206	1,602,763
Facilitated research	689,315	—	689,315	—	—	689,315	503,405
Total program expenses	4,230,421	452,360	4,682,781	—	—	4,682,781	4,207,838
Management and general	921,355	—	921,355	—	—	921,355	917,102
Fundraising	297,550	—	297,550	—	—	297,550	254,490
Total management, general and fundraising expenses	1,218,905	—	1,218,905	—	—	1,218,905	1,171,592
Total expenses	5,449,326	452,360	5,901,686	—	—	5,901,686	5,379,430
Change in net assets	(11,072)	46,331	35,259	81,599	33,358	150,216	225,537
Net assets at beginning of year	4,702,783	37,783	4,740,566	1,929,246	821,327	7,491,139	7,265,602
Net assets at end of year	\$ 4,691,711	84,114	4,775,825	2,010,845	854,685	7,641,355	7,491,139

See accompanying notes to consolidated financial statements.

ORGANIZATION FOR TROPICAL STUDIES, INC. AND SUBSIDIARY

Consolidated Statement of Cash Flows

Year ended June 30, 2000

(with comparative financial information for the year ended June 30, 1999)

	Supplementary Information			
	Organization for Tropical Studies, Inc.			
	ESINTRO	2000 Total	1999 Total	
Cash flows from operating activities:				
Change in net assets	\$ 103,885	46,331	150,216	225,537
Adjustments to reconcile change in net assets to net cash provided by operating activities:				
Depreciation on buildings and equipment	285,095	342	285,437	278,645
(Increase) decrease in accounts receivable	(162,211)	(24,444)	(186,655)	20,029
Increase in grants & contributions receivable	(121,506)	—	(121,506)	(9,728)
Increase in other assets	(6,693)	(2,610)	(9,303)	(17,683)
Increase (decrease) in accounts payable and other liabilities	150,016	(13,478)	136,538	59,357
Increase in accumulated postretirement benefit liability	13,188	—	13,188	4,653
Contributions restricted for permanent endowments	(33,358)	—	(33,358)	(13,885)
Net unrealized loss (gain) on investments	9,274	—	9,274	(106,001)
Net cash provided by operating activities	237,690	6,141	243,831	440,924
Cash flows from investing activities:				
Purchases of equipment	(226,424)	(3,758)	(230,182)	(281,841)
Purchases of investments	(461,226)	—	(461,226)	(1,752,483)
Net proceeds from sales of investments	577,455	—	577,455	709,853
Net cash used in investing activities	(110,195)	(3,758)	(113,953)	(1,324,471)
Cash flows from financing activities:				
Contributions restricted for permanent endowments	33,358	—	33,358	13,885
Net cash provided by financing activities	33,358	—	33,358	13,885
Increase (decrease) in cash and cash equivalents	160,853	(2,383)	163,236	(869,662)
Cash and cash equivalents at beginning of year	1,342,969	17,542	1,360,511	2,230,173
Cash and cash equivalents at end of year	\$ 1,503,822	19,925	1,523,747	1,360,511

See accompanying notes to consolidated financial statements.

ORGANIZATION FOR TROPICAL STUDIES, INC. AND SUBSIDIARY

Notes to Consolidated Financial Statements

June 30, 2000

(with comparative financial information for the year ended June 30, 1999)

(1) Organization

The Organization for Tropical Studies, Inc. (the "Organization") is chartered as a nonprofit corporation under the laws of the State of North Carolina for the purpose of furthering education and research in tropical sciences, and is supported by a consortium of institutions of higher education located in North, Central and South America and South Africa. The Organization maintains its general office in Durham, North Carolina on the campus of Duke University, an administrative office in San Jose, Costa Rica, and three field stations in Costa Rica (La Selva, Las Cruces and Palo Verde) for instructional and research purposes.

Included in the consolidated financial statements of the Organization is *Estudios E Investigaciones Tropicales S.A.* (ESINTRO), a for-profit subsidiary of the Organization. ESINTRO was incorporated for sales made to field station visitors of food, lodging, clothing, beverages, and other miscellaneous items. The Organization is the sole stockholder of ESINTRO.

A summary of the financial data applicable to the operations in Costa Rica compared to total operations as included in the consolidated financial statements as of and for the years ended June 30, 2000 and 1999 is as follows:

	2000		1999	
	Costa Rican Operations	Total Operations	Costa Rican Operations	Total Operations
Total assets	\$2,812,392	8,354,050	2,901,433	8,054,108
Total liabilities	160,124	712,695	109,598	562,969
Total revenue and other support	5,028,661	6,051,902	3,990,452	5,604,967
Total expenses	4,994,743	5,901,686	4,251,428	5,379,430

Funding of the Organization is provided principally by dues from the member institutions, field stations and vehicle rental charges, tuition and fee charges for courses offered by the Organization, grants from the National Science Foundation and various private foundations, and private gifts. The Organization is dependent on the grants and private gifts to continue operating.

The Organization is exempt from Federal income taxes under Section 501(c)(3) of the Internal Revenue Code.

(2) Summary of Significant Accounting Policies

The consolidated financial statements of the Organization have been prepared on the accrual basis of accounting. The significant accounting policies followed are described below to enhance the usefulness of the consolidated financial statements to the reader.

(a) Principles of Consolidation

All significant intercompany balances and transactions have been eliminated in consolidation.

(b) Cash and Cash Equivalents

Except for \$256,690 as of June 30, 2000 and \$235,560 as of June 30, 1999 in bank accounts in Costa Rica and temporary investments of \$257,415 as of June 30, 2000 and \$206,034 as of June 30, 1999, cash is managed by Duke University. The Organization considers all investments with original maturities of less than 90 days to be cash equivalents.

(c) Investments

Investments in equity securities and debt securities are reported at fair value with unrealized gains and losses reported in the statement of activities. Investment income includes realized gains and losses on investments, interest and dividends.

(d) Land, Buildings and Equipment

Land, buildings and equipment are stated at cost at date of acquisition or fair value at date of donation in the case of gifts. Depreciation of buildings and equipment is provided over the estimated useful lives of the respective assets on the straight-line basis.

(e) Net Assets and Contributions

Net assets and revenues, expenses, gains and losses are classified based on the existence or absence of donor-imposed restrictions. Accordingly, net assets of the Organization are classified and reported as follows:

Permanently restricted – Net assets subject to donor-imposed stipulations that they be maintained permanently by the Organization. Generally, the donors of these assets permit the Organization to use all or part of the income earned on related investments for general or specific purposes.

Temporarily restricted – Net assets subject to donor-imposed stipulations that may or will be met either by actions of the Organization and/or the passage of time.

Unrestricted – Net assets that are not subject to donor-imposed stipulations.

Revenues from sources other than contributions are reported as increases in unrestricted net assets. Contributions are reported as increases in the appropriate category of net assets, except that contributions which impose restrictions that are met in the same fiscal year they are received are included in unrestricted revenues. Expenses are reported as decreases in unrestricted net assets. Gains and losses on investments are reported as increases or decreases in unrestricted net assets unless their use is restricted by explicit donor stipulations or by law. Expirations of temporary restrictions recognized on net assets (i.e., the donor-stipulated purpose has been fulfilled and/or the stipulated time period has elapsed) are reported as reclassifications from temporarily restricted net assets to unrestricted net assets. Temporary restrictions on gifts to acquire long-lived assets are considered met in the period in which the assets are acquired or placed in service.

Contributions, including unconditional promises to give, are recognized as revenues in the period received. Conditional promises to give are not recognized until the conditions on which they depend are substantially met. Contributions of assets other than cash are recorded at their estimated fair value at the date of gift. Contributions to be received after one year are discounted at a rate commensurate with the risk involved. Amortization of the discount is recorded as additional contribution revenue in accordance with donor-imposed restrictions, if any, on the contributions. Allowance is made for uncollectible contributions based upon management's judgment and analysis of the creditworthiness of the donors, past collection experience and other relevant factors.

(f) Translation of Foreign Currencies

Assets and liabilities denominated in Costa Rican colones (all "monetary items") are translated into U.S. dollars at the rate prevailing at the balance sheet date of 308.70 and 284.73 colones as of June 30, 2000 and 1999, respectively, to the U.S. dollar. Transactions in colones have been translated into U.S. dollars at rates prevailing at the transaction dates. Such rates ranged from 282.00 to 308.70 and 256.26 to 284.73 colones to the U.S. dollar during fiscal years 2000 and 1999, respectively. The translation of foreign currencies resulted in losses of \$2,195 and \$7,909 for fiscal years 2000 and 1999, respectively, which are included in the accompanying consolidated statement of activities.

(g) Functional Allocation of Expenses

The costs of providing the various programs and other activities of the Organization have been summarized on a functional basis in the statement of activities. Accordingly, certain costs have been allocated among the programs and supporting services benefited.

(h) Use of Estimates

The preparation of consolidated financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and judgments that affect the reported amounts of assets and liabilities and disclosures of contingencies at the date of the consolidated financial statements and revenues and expenses recognized during the reporting period. Actual results could differ from those estimates.

(i) Comparative Amounts

The financial statements include certain prior-year summarized comparative information in total but not by net asset class. Such information does not include sufficient detail to constitute a presentation in conformity with accounting principles generally accepted in the United States of America. Accordingly, such information should be read in conjunction with the Organization's consolidated financial statements for the year ended June 30, 1999, from which the comparative information was derived.

(3) Investments

Temporary investments of \$257,415 and \$206,034 which are included in cash and cash equivalents at June 30, 2000 and 1999, respectively, were invested in money market accounts, earning interest at 5.27% and 3.86% at June 30, 2000 and 1999, respectively. Investments at June 30, 2000 and 1999 consist of the following:

	<u>2000</u>	<u>1999</u>
Stocks	\$ 1,334	—
Bonds	1,490,393	1,758,780
Mutual funds:		
Common stocks	1,416,553	1,289,730
Corporate bonds	817,574	802,847
	<u>\$ 3,725,854</u>	<u>3,851,357</u>

(4) Land, Buildings and Equipment

Land, buildings and equipment are summarized at June 30, 2000 and 1999 as follows:

	<u>2000</u>	<u>1999</u>
Land	\$ 786,028	786,028
Land improvements	433,261	433,261
Buildings and improvements	2,287,798	2,264,827
Motor vehicles	405,810	343,645
Equipment	1,475,392	1,342,306
Furniture and furnishings	14,398	14,398
Construction-in-progress	49,524	40,315
	<u>5,452,211</u>	<u>5,224,780</u>
Less accumulated depreciation	<u>(2,875,835)</u>	<u>(2,593,149)</u>
	<u>\$ 2,576,376</u>	<u>2,631,631</u>

(5) **Net Assets**

The Organization has designated certain net assets classified as unrestricted for specific purposes or uses. As a result, substantially all of the net assets classified on the consolidated statement of financial position as unrestricted net assets at June 30, 2000 and 1999 have been invested in property and equipment or are designated for specific uses.

Unrestricted net assets consist of the following at June 30, 2000 and 1999:

	<u>2000</u>	<u>1999</u>
Net investment in property and equipment	\$ 2,576,376	2,631,631
Funds designated by governing board:		
Estimated severance pay	219,031	225,013
Asset renewal	1,115,431	935,297
Organizational support	472,456	508,469
Unrestricted and undesignated	392,531	440,156
	<u>\$ 4,775,825</u>	<u>4,740,566</u>

Temporarily restricted net assets consist of the following at June 30, 2000 and 1999:

	<u>2000</u>	<u>1999</u>
Term endowment funds to be used for fellowships	\$ 416,202	377,432
Contributions for station improvements and land acquisition	201,145	210,582
Educational programs	1,393,498	1,341,232
	<u>\$ 2,010,845</u>	<u>1,929,246</u>

Net assets were released from donor restrictions by incurring expenses satisfying the restricted purposes or by the passage of time. Purpose restrictions were accomplished by incurring \$1,736,747 in expenses for fellowships, station improvements, land acquisition and educational programs in 2000.

Permanently restricted net assets at June 30, 2000 and 1999 consist of perpetual endowment funds. The income from these investments in perpetuity is spendable for instruction, scholarships and operations.

(6) **Relationship with Duke University**

The Organization has an agreement with Duke University whereby the University acts as fiscal agent for the Organization. As a result of this agreement, certain federal and state grants and contracts are made to the University on the Organization's behalf. Total amounts received by the University and reported as revenues under grants and contracts amounted to \$947,872 in fiscal year 2000 and \$825,640 in fiscal year 1999. Accounts receivable at June 30, 2000 and 1999 include \$52,732 and \$873, respectively, due from Duke University for amounts expended for grant purposes but not yet reimbursed.

During 2000 and 1999, the University assigned employees to work at the Organization. The Organization reimbursed the University for the salary expenses and fringe benefits of these employees, which totaled \$902,537 and \$1,051,297 for the years ended June 30, 2000 and 1999, respectively.

(7) **Contingencies**

Under Costa Rican law, an employee can receive as severance pay the equivalent of one month's salary for every year of employment, up to a maximum of eight years, if it is determined by the courts that his employment was terminated without just cause, plus one additional month's salary. If all employees of the Organization were terminated at June 30, 2000 and 1999 without just cause, the liability for severance pay would be \$219,031 and \$225,013, respectively. The Organization has designated cash of the identical amounts to make payments under the law, if necessary. The Board of Directors has designated a portion of the unrestricted net assets for the estimated contingent severance pay liability. Severance payments would be made from the designated net assets, and an amount equal to each year's increase or decrease in estimated liability will be transferred to or from the designated net assets. Payment of such contingent liability is not probable at June 30, 2000 and, accordingly, such amount is not recorded as a liability in the accompanying consolidated statement of financial position.

The Organization is involved in claims and legal actions arising in the ordinary course of business. In the opinion of management, the ultimate disposition of these matters will not have a material adverse effect on the Organization's financial position, results of operations or liquidity.

(8) **Benefit Plans**

Duke University employees assigned to the Organization participate in either the University's contributory defined contribution pension plan or the University's noncontributory defined benefit pension plan. The salary and fringe benefit expenses disclosed in footnote 6 include the net pension expenses associated with these plans.

These employees are also participants in the University's unfunded defined benefit postretirement medical plan. The net periodic postretirement benefit cost amounted to \$13,188 and \$4,653 for the years ended June 30, 2000 and 1999, respectively, and the associated liability was \$129,986 and \$116,798 as of June 30, 2000 and 1999, respectively.

It is not possible to present separately the actuarial present value of benefit obligations or the net assets available for benefits under either the contributory defined contribution or the noncontributory defined benefit pension plans because no determination has been made of the allocation of such amounts between Duke University and the Organization. Furthermore, it is not possible to present separately the actuarially determined accumulated postretirement benefit obligation for the Organization for the postretirement benefit plan because no determination has been made of the allocation of such amounts between Duke University and the Organization.

(9) **Additional Funding**

The Organization has received grants and contributions totaling \$4,117,645 during the year and subsequent to June 30, 2000 that have not been recorded as revenues in the consolidated statement of activities since these grants and contributions will be available to the Organization in fiscal year 2001.

